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HOUSEHOLD REFRIGERATORS, COMBINATION REFRIGERATOR-FREEZERS, AND HOUSEHOLD FREEZERS

AMERICAN NATIONAL STANDARD

ANSI/AHAM HRF-1-1979

(Revision of ANSI B38.1-1970)

The Association of Home Appliance Manufacturers' Standards are adopted voluntarily by AHAM's members in the public interest. They are designed to eliminate misunderstanding between manufacturers and consumers and to assist the consumer in buying home appliances.

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American National Standard ANSI/AHAM HRF-1-1979 Household Refrigerators, Combination Refrigerator-Freezers, and Household Freezers

1. PURPOSE

1.1 The purpose of this standard is to establish a uniform and repeatable procedure or standard method for measuring specified product characteristics of household refrigerators and household freezers. The standard methods and the recommended levels of performance where they appear are intended to provide a means by which different brands and models of household refrigerators and household freezers can be compared and evaluated with respect to characteristics of significance in the design and use of the products.

The standard methods and recommended levels of performance are not intended to prevent improvement and innovation in product testing, design or performance.

2. SCOPE

2.1 This standard applies to household refrigerators as defined in 3.1 and household freezers as defined in 3.2.

2.2 This standard covers definitions, methods of computing volumes and shelf areas, methods of determining volumes of special features, performance test procedures, durability test procedures, methods for determining energy consumption and energy factor and safety.

2.3 This standard does not include methods of testing household refrigerators and household freezers using gas fuel as defined in ANSI Standard Z21.19.

2.4 The principal subdivisions of this standard are as follows:

Section 1 — Purpose

Section 2 — Scope

Section 3 — Definitions

Section 4 — Method of Computing Total Refrigerated Volume and Total Shelf Area of Household Refrigerators

Section 5 — Method of Computing Total Refrigerated Volume and Total Shelf Area of Household Freezers

Section 6 — Method of Computing the Volume of Special Features of Household Refrigerators and Household Freezers

Section 7 — Performance Test Procedures and Recommended Levels of Performance for Household Refrigerators and Household Freezers

Section 8 — Durability Test Procedures and Recommended Levels of Performance for Household Refrigerators and Household Freezers

Section 9 — Method of Determining the Energy Consumption and Freezer Temperature of Household Refrigerators and Household Freezers

Section 10 — Method of Computing the Energy Factor of Household Refrigerators and Household Freezers

Section 11 — Safety

3. DEFINITIONS

3.1 **Household Refrigerator.** A cabinet or any part of a cabinet which is designed for the refrigerated storage of food at temperatures above 32°F (0°C) which has a source of refrigeration and which is intended for household use. It may include a compartment for the freezing and storage of ice and/or for storage of food at temperatures below 32°F (0°C).

3.1.1 **Basic Refrigerator.** A refrigerator which includes a compartment for the freezing and storage of ice and intended for short-term storage of food at temperatures below 32°F (0°C) and normally above 8°F (−13.3°C). It is characterized by a refrigerated surface(s) that partially encloses the freezer compartment and cools the fresh food compartment by natural convection. It frequently has a customer-removable partition (called the chiller or drip tray) which when removed exposes an additional area of the freezer refrigerated surface to the fresh food compartment.

3.1.2 **All-Refrigerator.** A refrigerator which does not include a compartment for the storage of food at temperatures below 32°F (0°C). It may include a compartment of 7.1 liters or less for freezing and storage of ice.

3.1.3 **Combination Refrigerator-Freezer.** A cabinet which consists of two or more compartments, with at least one of the compartments designed for the refrigerated storage of foods at temperatures above 32°F (0°C) and with at least one of the compartments designed for the freezing and storage of frozen foods at temperatures of 8°F (−13.3°C) average or below, and typically capable of being adjusted by the user to a temperature of 0°F (− 17.8°C) or below.

3.2 Household Freezer. A cabinet which is designed for the extended storage of frozen food at an average temperature of 0°F (− 17.8°C) or below and with inherent capability for freezing of food, which has a source of refrigeration and which is intended for household use.

3.2.1 Chest Type. A household freezer which is accessible from the top.

3.2.2 Upright (Vertical) Type. A household freezer which is accessible from the front.

3.3 Types of Defrost Systems. These types of defrost systems apply to Household Refrigerators and Household Freezers except as noted.

3.3.1 Manual Defrost. Manual defrost is one in which defrosting of the refrigerated surface is accomplished by natural or manual means with manual initiation and manual termination of the over-all defrost operation.

3.3.2 Semi-Automatic Defrost. A system in which the defrost cycle is manually initiated and automatically terminated, with automatic resumption of normal refrigeration at the conclusion of the defrost operation. Defrost water is disposed of automatically or collected in a container for subsequent manual removal. A means of accelerating the rate of defrost may or may not be included in the product design.

3.3.3 Automatic Defrost (No-Frost). A system in which the defrost cycle is automatically initiated and terminated, with resumption of normal refrigeration at the conclusion of the defrost operation. The system automatically prevents the permanent formation of frost on all refrigerated surfaces. Nominal refrigerated food temperatures are maintained during operation of the automatic defrost system(s). The defrost water is disposed of automatically.

3.3.4 Partial Automatic (Cycle) Defrost (Household Refrigerators). A system in which the refrigerated surfaces of the freezer compartment are defrosted manually and the refrigerated surfaces of the fresh food compartment are defrosted automatically. Defrost water from the fresh food compartment is disposed of automatically or collected in a container for subsequent manual removal.

3.4 Air Ducts. Passages which direct the flow of air.

3.5 Automatic Ice Maker. A device, connected to a water supply, which automatically produces, harvests, and stores ice in a storage bin, with means to automatically interrupt the harvesting operation when the bin is filled to a predetermined amount.

3.5.1 Cyclic Type. An automatic ice maker with separate and sequential water fill, freezing and harvesting phases of the ice-making operation.

3.5.2 Non-Cyclic (Continuous) Type. An automatic ice maker with simultaneous water supply, freezing and/or harvesting phases in the ice-making operation.

3.5.3 Ice Storage Bin Rating. The capacity of an automatic ice maker storage bin is the average weight of ice contained in the bin when the bin-fill device terminates the ice-making operation.

3.6 Baffle. A plate, wall or partition which is designed to perform one or more of the following functions:

(a) Prevent contact of food with refrigerated surfaces.

(b) Prevent dripping of condensate on food.

(c) Regulate and/or direct circulation of refrigerated air.

3.7 Cabinet Breaker Strip. A separate insulating element or integral insulating extension of the cabinet interior surfaces around the periphery of the cabinet door or drawer opening(s) which functions as a thermal barrier to minimize heat flow to the interior of the cabinet.

3.8 Drip (Drain) Trough. A device for channeling water.

3.9 Door.

3.9.1 Right-hand Door. A door which is hinged on the right-hand side when viewed facing the cabinet.

3.9.2 Left-hand Door. A door which is hinged on the left-hand side when viewed facing the cabinet.

3.9.3 Door Dike. A projection on the door which extends into the refrigerated compartment(s) and which functions primarily as a barrier to minimize heat flow to the interior of the cabinet.

3.10 Fan Shroud. A protective housing which surrounds the fan and which may also direct the flow of air.

3.11 Ice Tray. A container for freezing water into ice.

3.11.1 Automatic Fill Ice Tray. A tray which is automatically filled with water for freezing into ice.

3.11.2 Ice Tray Capacity Rating. The weight of water with the tray filled to within 1/8 in. (within 3 mm) of the top and with the grids in place or filled per manufacturer's instructions.

3.12 Liner. The enclosure forming the interior of the fresh food compartment and/or some freezer compartment(s). The complete liner comprises the compartment liner in the cabinet, the exposed breaker strip surfaces and the door liner(s).

3.13 Plaque and/or Sump. The volume generated by embossed areas on the interior surfaces of the fresh food and/or freezer compartment(s).

3.14 Shelf. Any generally horizontal surface within the cabinet which is provided for the storage of food.

3.14.1 Adjustable Shelf. One which can have its vertical position changed without the use of tools.

3.14.2 Door Shelf. Any surface on the door which can be used for the storage of food.

3.14.3 Full Shelf. One which essentially fills the interior cross-section of the cabinet.

3.14.4 Fractional Shelf. One which is less than either the width or the depth, or both, of the full shelf.

3.14.5 Revolving Shelf. One which can be either partially or fully rotated.

3.14.6 Roll-out, Sliding or Swing-out Shelf. One which can roll, slide, or pivot forward on its support(s).

3.15 Total Shelf Area.

3.15.1 For Household Refrigerators, a calculated value based on the net areas of the main shelves, door shelves, bottoms of suspended containers or dispensers, and the bottom of the liner(s) of the fresh food and freezer compartments. (See Section 4.)

3.15.2 For Household Freezers, a calculated value based on the net areas of main shelves, door shelves, bottoms of suspended containers or dispensers, and the bottom of the Liner(s). (See Section 5.)

3.16 Fresh Food Compartment. In a Household Refrigerator, that compartment(s) designed for the refrigerated storage of food at an average temperature above 32°F (0°C). Special compartments designed for the storage of fresh foods at temperatures near 32°F (0°C) shall be considered part of the fresh food compartment. Special compartments of combination refrigerator-freezers operating at average temperatures between 8°F (−13.3°C) and 32°F (0°C) shall be considered part of the fresh food compartment.

3.17 Freezer Compartment. In a basic refrigerator, the compartment designed for short-term storage of food at temperatures below 32°F (0°C); in a combination refrigerator-freezer, the compartment(s) designed for storage of foods at temperatures of 8°F (−13.3°C) average or lower; and in a household freezer the compartment(s) designed for extended storage of frozen foods at an average temperature of 0°F (−17.8°C) or below and having inherent capability for freezing of food.

3.18 Special Compartments. Compartments designed for maintaining special environmental conditions for a particular type of product or purpose.

3.18.1 Butter, Margarine, or Cheese Compartment(s). A compartment provided for the storage of butter, margarine or cheese.

3.18.2 Butter or Margarine Conditioner. An enclosed compartment which is provided for the storage of butter and/or margarine and which has an auxiliary temperature control.

3.18.3 Chiller or Drip Tray. A tray or drawer which is located beneath the refrigerated surfaces of a manual or semi-automatic defrosting refrigerator for chilling of food and/or collecting of water during defrosting. It may also serve as a baffle to regulate compartment temperature.

3.18.3.1 Volume of Chiller or Drip Tray. The product of the mean inside width and length of the tray and the mean height between the inside bottom of the tray and the outside bottom of the surface of the refrigerated plate or coil when the tray is in its lowest position.

3.18.4 Crisper. An enclosed compartment or container provided primarily to retard the dehydration of fruits and vegetables.

3.18.5 Ice Storage Bin. A container in which ice can be stored.

3.18.6 Meat Keeper. An enclosed compartment or container which is designed for the storage of meat at or near 32°F (0°C).

3.19 Steady State Condition. Steady state condition shall be considered to be established during a stabilization period under either cyclic or continuous operating conditions when,

(a) The average fresh food compartment temperature in household refrigerators does not vary more than 1°F (0.6°C) in 2 cycles (if cycling occurs) or 2 hours, whichever is longer.

(b) The average freezer compartment temperature, during no-load pull down test only for basic refrigerators, combination refrigerator-freezers, or household freezers, does not vary more than 1°F (0.6°C) in 2 cycles (if cycling occurs) or 2 hours, whichever is longer.

(c) The average frozen food temperature in basic refrigerators, combination refrigerator-freezers, or household freezers is changing at a rate not exceeding 1°F (0.6°C) in 24 hours, based on temperature observations covering a period of not less than 8 hours.

3.20 Volume.

3.20.1 Fresh Food Compartment Volume. That portion of the total refrigerated volume above 32°F (0°C) average for basic refrigerators and all-refrigerators or above 8°F (−13.3°C) average for combination refrigerator-freezers. (See Section 4.) Regardless of its temperature, the volume of the refrigerated chiller tray and other special compartment(s) for storage of fresh food near 32°F (0°C) is to be included in the fresh food compartment volume.

3.20.2 Freezer Compartment Volume. That portion of the total refrigerated volume below 32°F (0°C) average for basic refrigerators (exception, see Paragraph 3.20.1) and 8°F (−13.3°C) average or below for combination refrigerator-freezers and household freezers. (See Section 4 and Section 5.)

3.20.3 Total Refrigerated Volume. For a household refrigerator, the sum of the fresh food compartment volume and the freezer compartment volume.

For a household freezer, the freezer compartment volume.

4. METHOD OF COMPUTING TOTAL REFRIGERATED VOLUME AND TOTAL SHELF AREA OF HOUSEHOLD REFRIGERATORS

4.1 **Scope of Section 4.** This section describes methods for computing total refrigerated volume (see Paragraph 3.20) and total shelf area (see Paragraph 3.15) of Household Refrigerators.

Section 4 is intended to provide a uniform means for determining the size, taking into consideration the special features and/or functional components which are located within the refrigerated compartment(s). It is not intended to provide a means of measuring the food-storage capacity.

4.2 **Total Refrigerated Volume** (see Paragraph 3.20).

4.2.1 **Volumes.**

4.2.1.1 **Volumes to be included.** The total refrigerated volume is to include:

(a) Volume occupied by special features, such as baskets, crispers, meat pans, chiller trays, ice makers (including storage bins for automatic ice makers) and water coolers.

(b) Volume occupied by cabinet shelves, door shelf fronts and bottoms, and doors of special feature compartments located within the door.

(c) Volume occupied by features, such as light shields, trims, and aesthetic items, which are removable without the use of tools.

4.2.1.2 **Volumes to be deducted.** The total refrigerated volume is not to include:

(a) Volume occupied by parts necessary for the proper functioning of the unit, such as evaporator doors, cooling coils, evaporators, air ducts, drip troughs, condensers, baffles, and fan shrouds.

(b) Volume occupied by door dikes which do not serve as shelves.

(c) Volume occupied by partitions and projections within the door(s) enclosing a compartment which do not serve as shelves and which, collectively, exceeds a volume of more than 0.05 cubic foot (1.4 liters).

(d) Volume between the deductible door dikes and cabinet breaker strips or adjacent liner wall.

(e) Volume occupied by fixed projections, such as control knobs, shelf hangers, shelf and pan rails, and thermostat escutcheons, which collectively, exceeds a volume of more than 0.05 cubic foot (1.4 liters) per compartment.

4.2.2 **Method of Computation.**

4.2.2.1 All linear dimensions are to be measured to the nearest 1/16 inch (nearest 0.2 cm).

4.2.2.2 Divide the fresh food compartment volume and the freezer compartment volume into various sections having similar width and depth dimensions (see Figures 4-1 through 4-6).

4.2.2.3 Calculate the volume of each section and the volume of all shaded spaces shown in Figures 4-1 through 4-6. Summate separately the volumes of the fresh food compartment sections and freezer compartment sections to determine the total unadjusted fresh food compartment volume and the total unadjusted freezer compartment volume.

4.2.2.4 Deduct from both the total refrigerated spaces (the total unadjusted fresh food compartment volume and the total unadjusted freezer compartment volume) the volumes of those items listed in Paragraph 4.2.1.2 and shown with double cross-hatching in Figures 4-1 through 4-12 in order to determine the fresh food compartment volume and the freezer compartment volume.

4.2.2.5 Determine the total refrigerated volume by adding the fresh food compartment volume and the freezer compartment volume.

4.2.3 **Data To Be Reported.** The total refrigerated volume is to be reported to the nearest 0.1 cubic foot (nearest 1.0 liter).

The fresh food compartment volume is to be reported to the nearest 0.01 cubic foot (nearest 0.1 liter).

The freezer compartment volume is to be reported to the nearest 0.01 cubic foot (nearest 0.1 liter).

4.3 **Legend for Figures 4-1 through 4-12.** Figures 4-1 through 4-12 show typical Household Refrigerators, and are not intended to cover all design variations. However, a combination of components from the various figures may be used for other designs.

The dimension symbols used in the figures are:

H_C — Height of fresh food compartment.
H_F — Height of freezer compartment.
W_C — Width of fresh food compartment.
W_F — Width of freezer compartment.
D_C — Depth of fresh food compartment.
D_F — Depth of freezer compartment.
D_{C3} — Subscript numerals are typical of section variations used to compute individual volumes.

The cross-hatchings used in the figures indicate:

▨ — Volume to be included.
▩ — Volume to be deducted.

4.4 **Total Shelf Areas** (see Paragraph 3.15).

4.4.1 **Areas.**

4.4.1.1 The total shelf area is to be determined from the areas of the main shelves, door shelves, bottoms of suspended containers or dispensers, and the bottom of the liner(s) of the fresh food and freezer compartments.

4.4.2 Clearances. The area of any part of a shelf in the fresh food compartment which has less than 4 inches (10.2 cm) clearance above the shelf is not to be included in the total shelf area, except on the door or as otherwise provided in Paragraph 4.4.3.

4.4.3 Method of Computation.

4.4.3.1 Units of Measurements. All linear dimensions are to be measured to the nearest 1/16 inch (nearest 0.2 cm).

4.4.3.2 Shelves in Fresh Food Compartment.

4.4.3.2.1 Full Shelves and Liners. The area of the full shelves and of the bottom of the liner(s) is to be the product of the mean depth and mean width as shown in Figures 4-13 and 4-14.

If the bottom of the liner(s) cannot qualify as a full shelf, its area is to be computed as the area of a cutout shelf or a fractional shelf.

The depth dimension used for computing the shelf area is to be measured from the front of the shelf. (See Figures 4-13 and 4-14.)

The depth of the shelf is to be the distance from the front edge of the shelf to the rear liner or to a point 1½ inches (3.8 cm) beyond the rear edge of the shelf, whichever is less. (See Figures 4-13 and 4-14.)

The width of a shelf is to be measured to the liner side(s) or to a point 1½ inches (3.8 cm) beyond the shelf edge, whichever is less. (See Figures 4-13 and 4-14.)

4.4.3.2.2 Fractional Shelves. The area of fractional shelves is to be the product of the width and depth, including the allowable overhang, determined in accordance with Paragraph 4.4.3.2.1 and Figure 4-14.

4.4.3.2.3 Cutout Shelves. When any part of a full shelf or a fractional shelf is cut out, the area of the cutout which exceeds the allowable overhang as determined in accordance with Paragraph 4.4.3.2.1 is to be deducted from the calculated shelf area. (See Figure 4.14.)

4.4.3.3 Shelves in Freezer Compartment. The area of shelves in the freezer compartment is to be included in the total shelf area provided there is a minimum clearance of 2 inches (5.1 cm) above such shelves. (See Figures 4-13 and 4-14.)

4.4.3.4 Door Shelves. The area of door shelves is to be the product of the mean depth and mean width of the shelf. The area of any part of a door shelf having an access clearance of less than 2 inches (5.1 cm) is not to be included in the total shelf area. (See Figures 4-13 and 4-14.)

4.4.3.5 Suspended Containers. The area of the bottom of suspended containers is to be included in the total shelf area provided there is a minimum clearance of 2 inches (5.1 cm) above the bottom of the container. (See Figure 4-16.)

4.4.4 Data To Be Reported. The total shelf area is to be reported to the nearest 0.1 square foot (nearest 100 square centimeters).

4.5 Legend for Figures 4-13 through 4-17. Figures 4-13 through 4-17 show typical shelf configurations for Household Refrigerators, and are not intended to cover all design variations. However, a combination of components from the various figures may be used for specific designs.

The dimension symbols used in the figures indicate:

D — Depth of cabinet or shelf from front edge of shelf.

W — Width of cabinet or shelf.

▨ — Area to be deducted.

5. METHOD OF COMPUTING TOTAL REFRIGERATED VOLUME AND TOTAL SHELF AREA OF HOUSEHOLD FREEZERS

5.1 Scope of Section 5. This section describes methods for computing total refrigerated volume (see Paragraph 3.20) and total shelf area (see Paragraph 3.15) of Household Freezers.

Section 5 is intended to provide a uniform means for determining the size of the freezer, taking into consideration the special features and/or functional components which are located within the refrigerated compartment(s). It is not intended to provide a means of measuring the food-storage capacity.

5.2 Total Refrigerated Volume.

5.2.1 Volumes.

5.2.1.1 Volumes to be included. The total refrigerated volume shall include:

(a) Volume occupied by special features, such as can or package racks, dividers or dispensers (provided such features are not projections — see Paragraphs 5.2.1.2c and 5.2.1.2e), baskets, compartment fronts, ice makers and non-refrigerated shelves.

(b) Volume occupied by door-shelf fronts and bottoms, doors of special feature compartments located within the door.

(c) Volume occupied by aesthetic items and features, such as light shields, trims and shelf, pan and basket rails, which are removable without the use of tools.

5.2.1.2 Volumes to be deducted. The total refrigerated volume is not to include:

For Legend See Par. 4.3

Deduct volume occupied by evaporator door (see Fig. 4-6)

Deduct volume occupied by top dike and space between it and cabinet wall (see Fig. 4-5)

Deduct volume between evaporator top and liner top unless 2" or more and is recommended by manufacturer as freezer compartment volume (see Fig. 4-6)

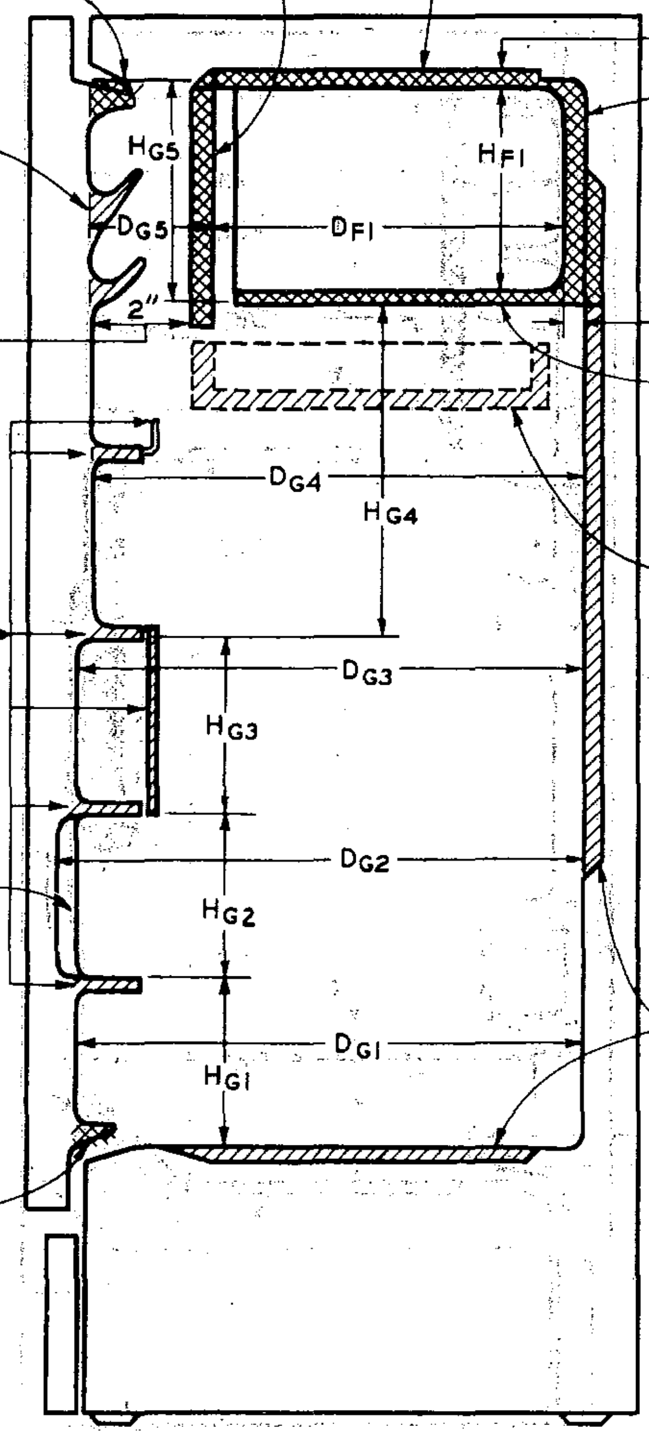
Include volume occupied by egg shelves

Include volume between interior door panel and evaporator door if 2" or more, providing there are shelves on the door

Include volume occupied by horizontal shelves, shelf fronts or compartment doors

When vertical dikes are cut back, deduct the volume occupied by the actual dike

Deduct the bottom dike or the volume between it and cabinet wall when bottom dike is not used as a shelf (see Fig. 4-5)



Less than 2"

Deduct volume between evaporator and liner side and rear walls if less than 4" (see Fig. 4-6, 4-7 and 4-8)

Less than 4"

Deduct volume occupied by evaporator (see Fig. 4-6, 4-7 and 4-8)

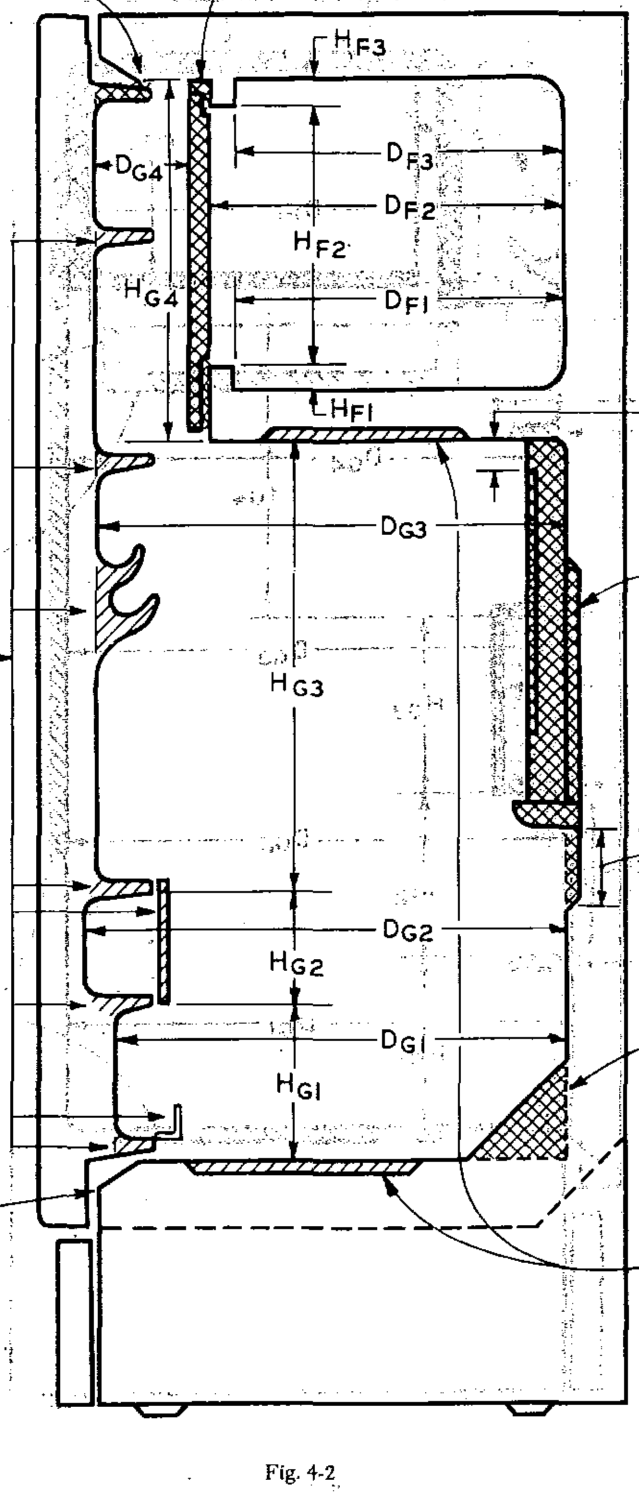
Include volume occupied by chiller tray

Include volume of shaded plaques and sumps (see Fig. 4-5)

Fig. 4-1

Single Door Combination Refrigerator-Freezer (Total Refrigerated Volume)

For Legend See Par. 4.3



Deduct volume occupied by top dike and space between it and cabinet wall (see Fig. 4-5)

Deduct space occupied by evaporator door (see Fig. 4-7 and 4-8)

If less than 4", deduct volume above evaporator

Include volume occupied by horizontal shelves, egg shelves, shelf fronts or compartment doors

Deduct volume occupied by evaporator, drain trough, drain space, and space between evaporator and liner wall

If less than 4", deduct volume below trough

Deduct volume occupied by projections formed into liner for compressor clearance, insulation, etc.

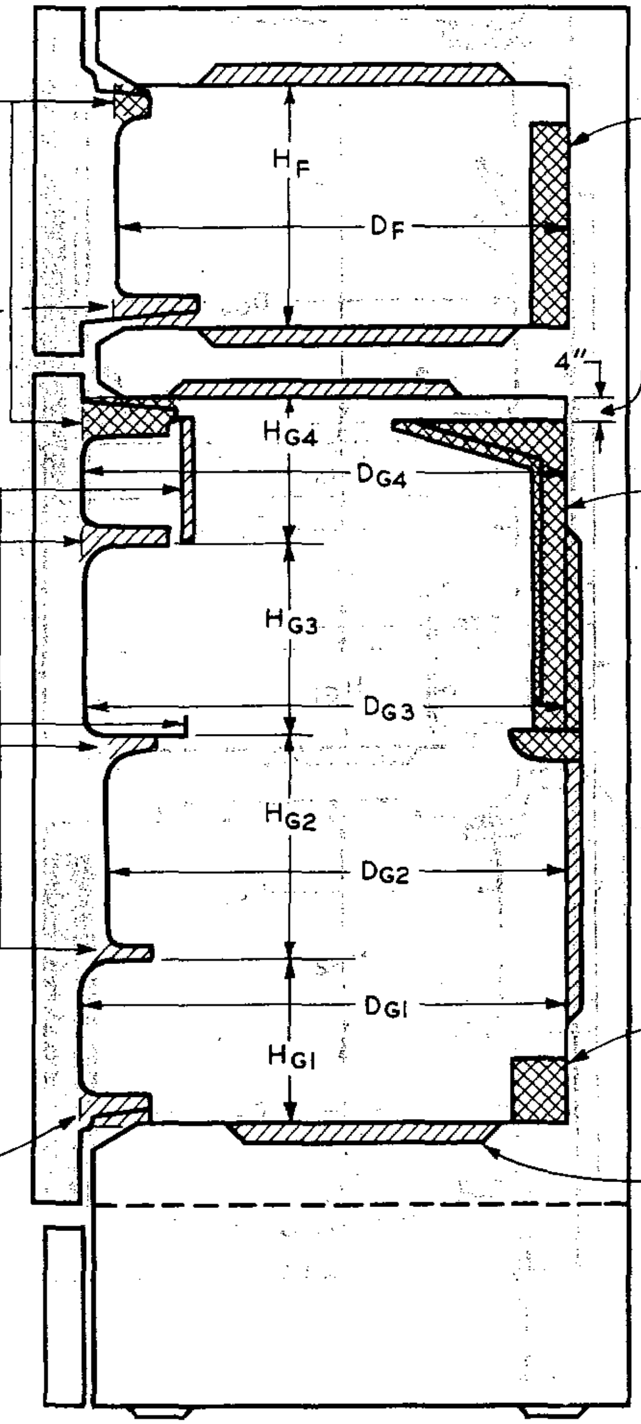
Include volume between bottom dike and cabinet wall when bottom dike is used as a shelf (see Fig. 4-5)

Include volume of liner plaques and sumps (see Fig. 4-5)

Fig. 4-2

Single-Door Combination Refrigerator-Freezer (Total Refrigerated Volume)

For Legend See Par. 4.3



Deduct volume occupied by top dike and space between it and cabinet wall (see Fig. 4-5)

Deduct volume occupied by air ducts or evaporator (see Fig. 4-9 and 4-10)

Include volume above evaporator if 4" or more

Deduct volume occupied by evaporator, drain trough, drain space, and space between evaporator and liner wall

Include volume occupied by horizontal shelves, shelf fronts or compartment doors

Deduct volume occupied by projections formed into liner for compressor clearance, insulation, etc.

Include volume between bottom dike and cabinet wall when bottom dike is used as a shelf (see Fig. 4-5)

Include volume of liner plaques and sumps (see Fig. 4-5)

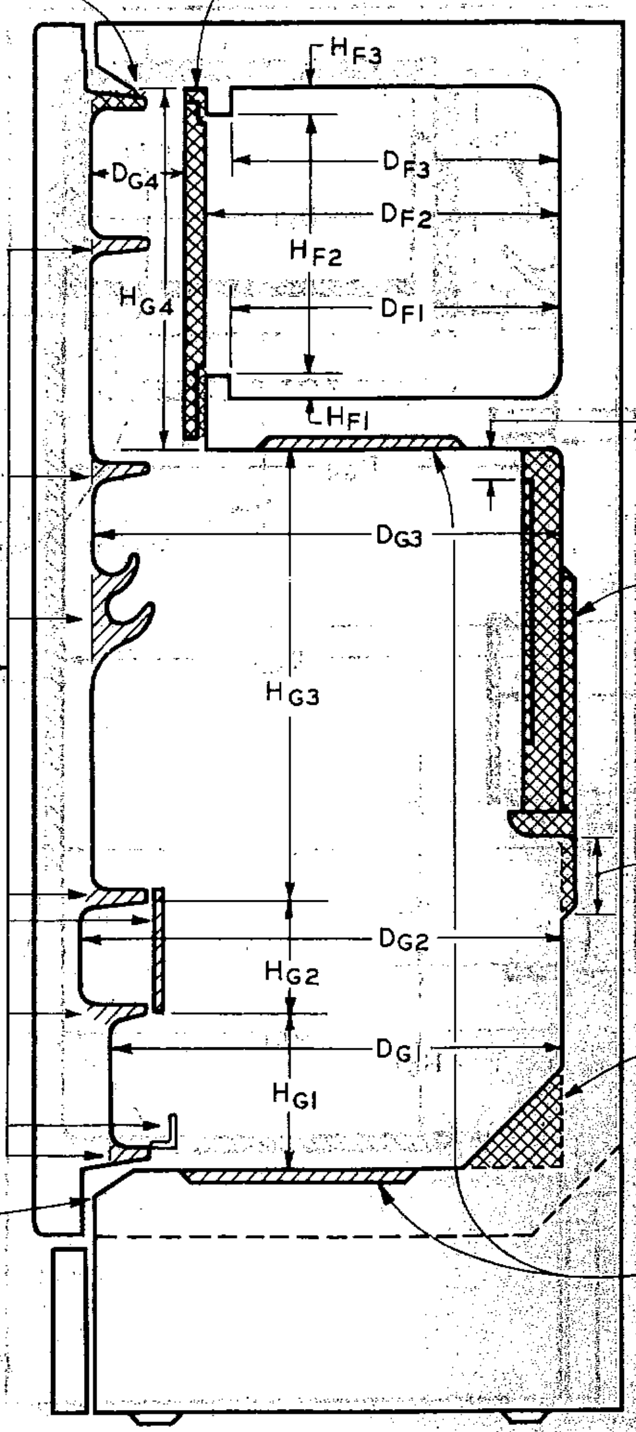
Fig. 4-3

Two-Door Combination Refrigerator-Freezer with Top Mounted Freezer (Total Refrigerated Volume)

For Legend See Par. 4.3

Deduct volume occupied by top dike and space between it and cabinet wall (see Fig. 4-5)

Deduct space occupied by evaporator door (see Fig. 4-7 and 4-8)



If less than 4", deduct volume above evaporator

Include volume occupied by horizontal shelves, egg shelves, shelf fronts or compartment doors

Deduct volume occupied by evaporator, drain trough, drain space, and space between evaporator and liner wall

If less than 4", deduct volume below trough

Deduct volume occupied by projections formed into liner for compressor clearance, insulation, etc.

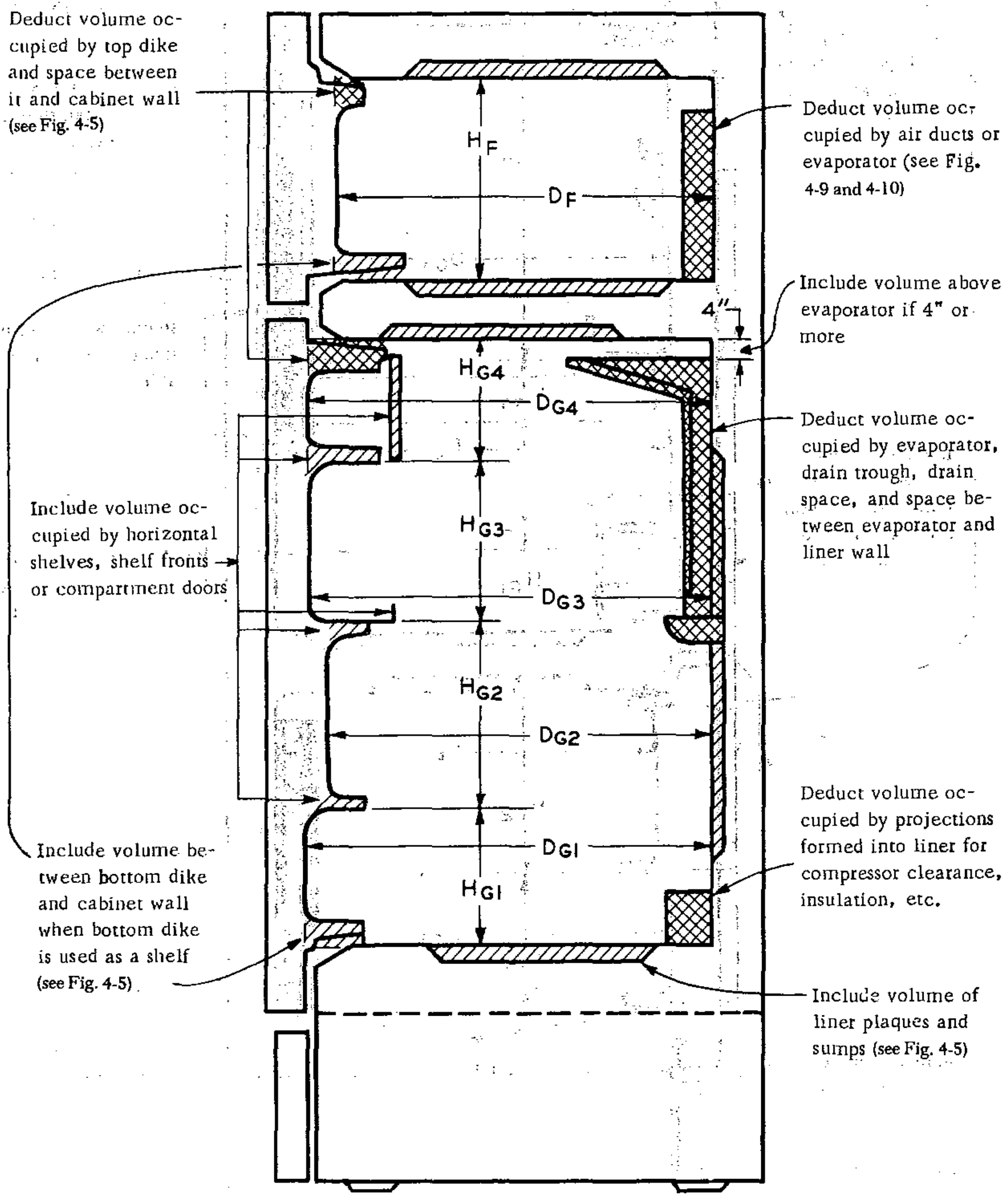
Include volume between bottom dike and cabinet wall when bottom dike is used as a shelf (see Fig. 4-5)

Include volume of liner plaques and sumps (see Fig. 4-5)

Fig. 4-2

Single-Door Combination Refrigerator-Freezer (Total Refrigerated Volume)

For Legend See Par. 4.3



Deduct volume occupied by top dike and space between it and cabinet wall (see Fig. 4-5)

Deduct volume occupied by air ducts or evaporator (see Fig. 4-9 and 4-10)

Include volume above evaporator if 4" or more

Deduct volume occupied by evaporator, drain trough, drain space, and space between evaporator and liner wall

Include volume occupied by horizontal shelves, shelf fronts or compartment doors

Deduct volume occupied by projections formed into liner for compressor clearance, insulation, etc.

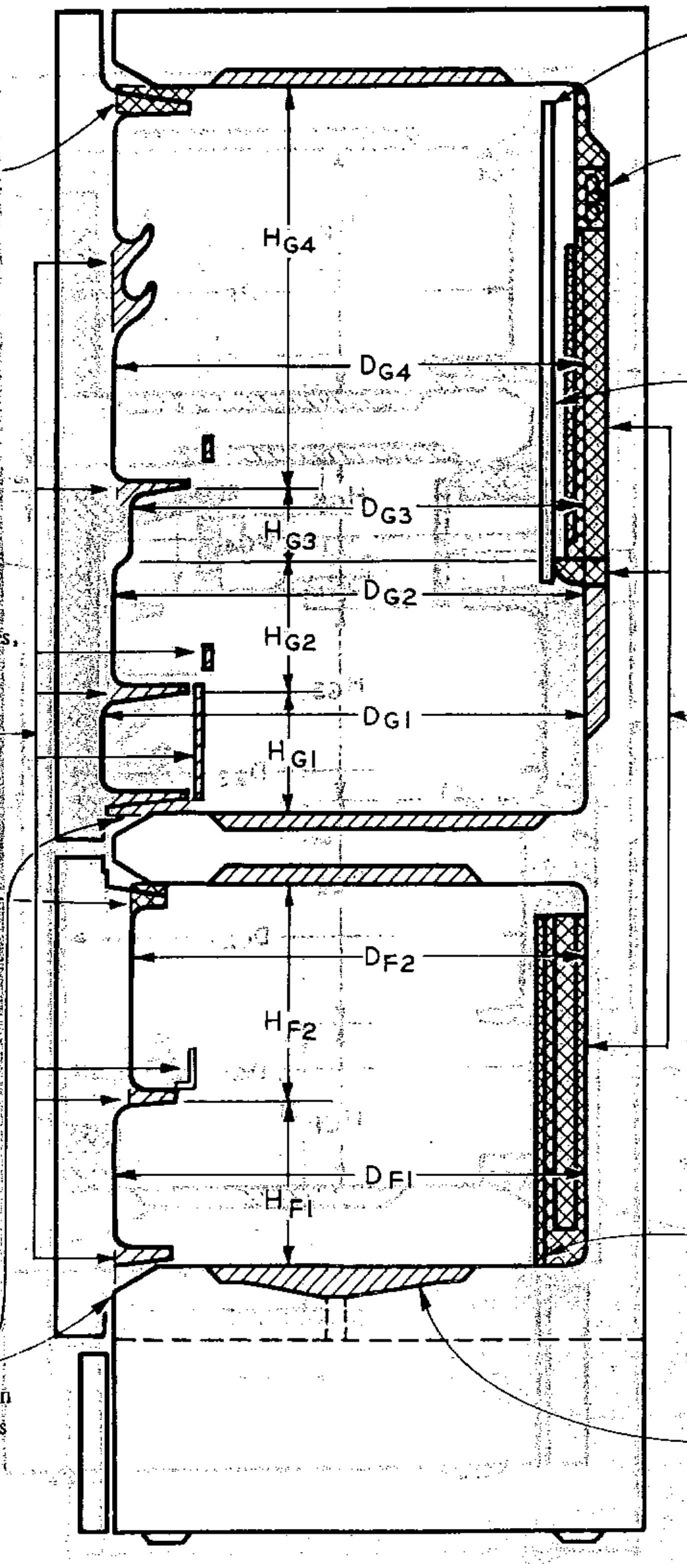
Include volume between bottom dike and cabinet wall when bottom dike is used as a shelf (see Fig. 4-5)

Include volume of liner plaques and sumps (see Fig. 4-5)

Fig. 4-3

Two-Door Combination Refrigerator-Freezer with Top Mounted Freezer (Total Refrigerated Volume)

For Legend See Par. 4.3



Deduct volume occupied by top dike and space between it and cabinet wall (see Fig. 4-5)

Include volume occupied by egg shelves, horizontal shelves, shelf fronts or compartment doors

Include volume between bottom dike and cabinet wall when bottom dike is used as a shelf (see Fig. 4-5)

Nonfunctional and removable shroud

Deduct volume occupied by fan shrouds, fan covers, air grilles, etc., when fixed or necessary to system function (see Fig. 4-11)

Include volume occupied by evaporator shrouds which are nonfunctional and removable

Deduct volume occupied by evaporator, drain trough, drain space, and space between evaporator and liner walls

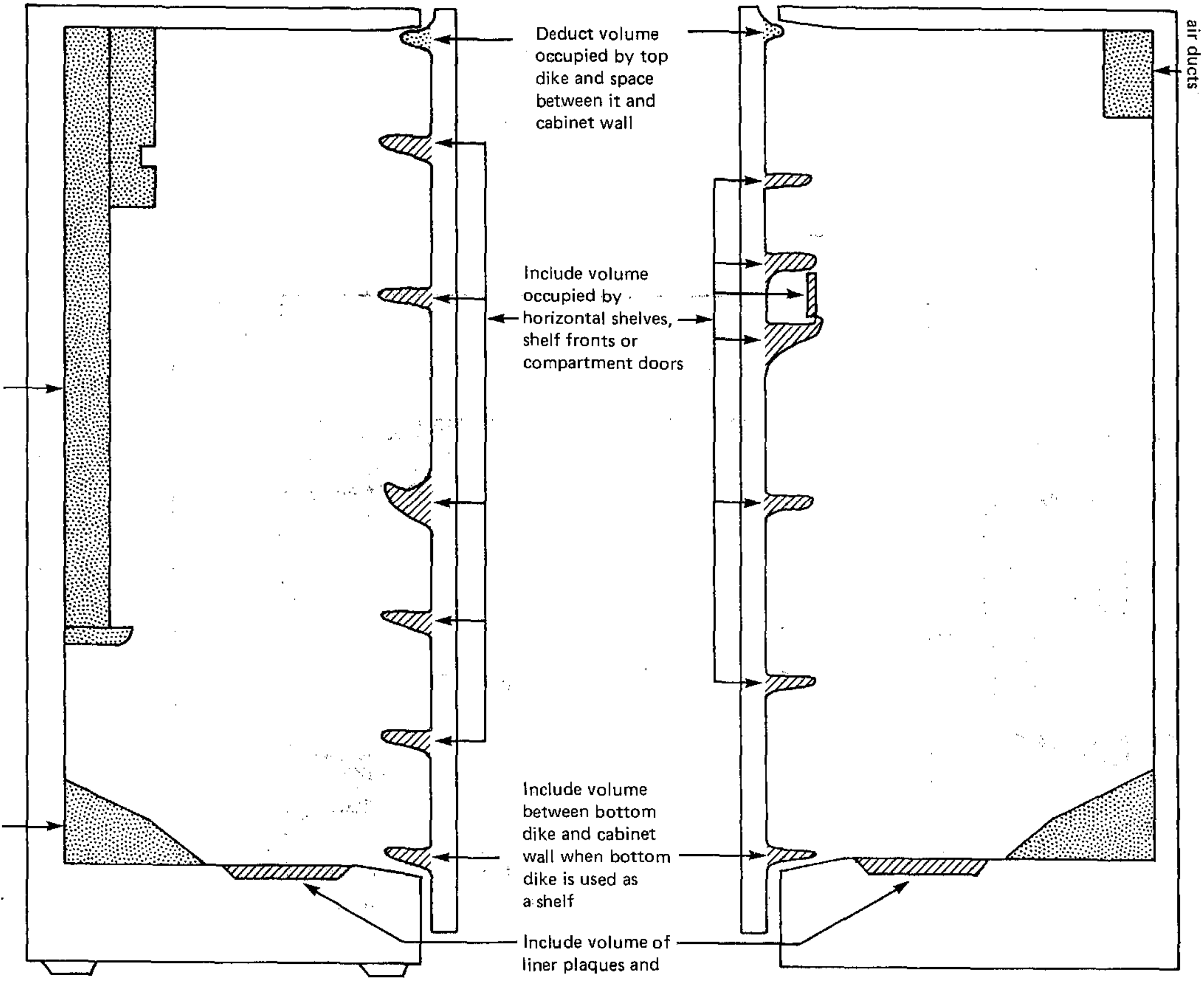
Deduct volume occupied by evaporator shrouds when fixed or necessary to system function

Include volume of shaded liner plaques and sumps (see Fig. 4-5)

Fig. 4-4

Two-Door Combination Refrigerator-Freezer with Bottom Mounted Freezer (Total Refrigerated Volume)

FIGURE 4–5



FREEZER COMPARTMENT

FRESH FOOD COMPARTMENT

Deduct volume occupied by top dike and space between it and cabinet wall

deduct volume occupied by air ducts

Include volume occupied by horizontal shelves, shelf fronts or compartment doors

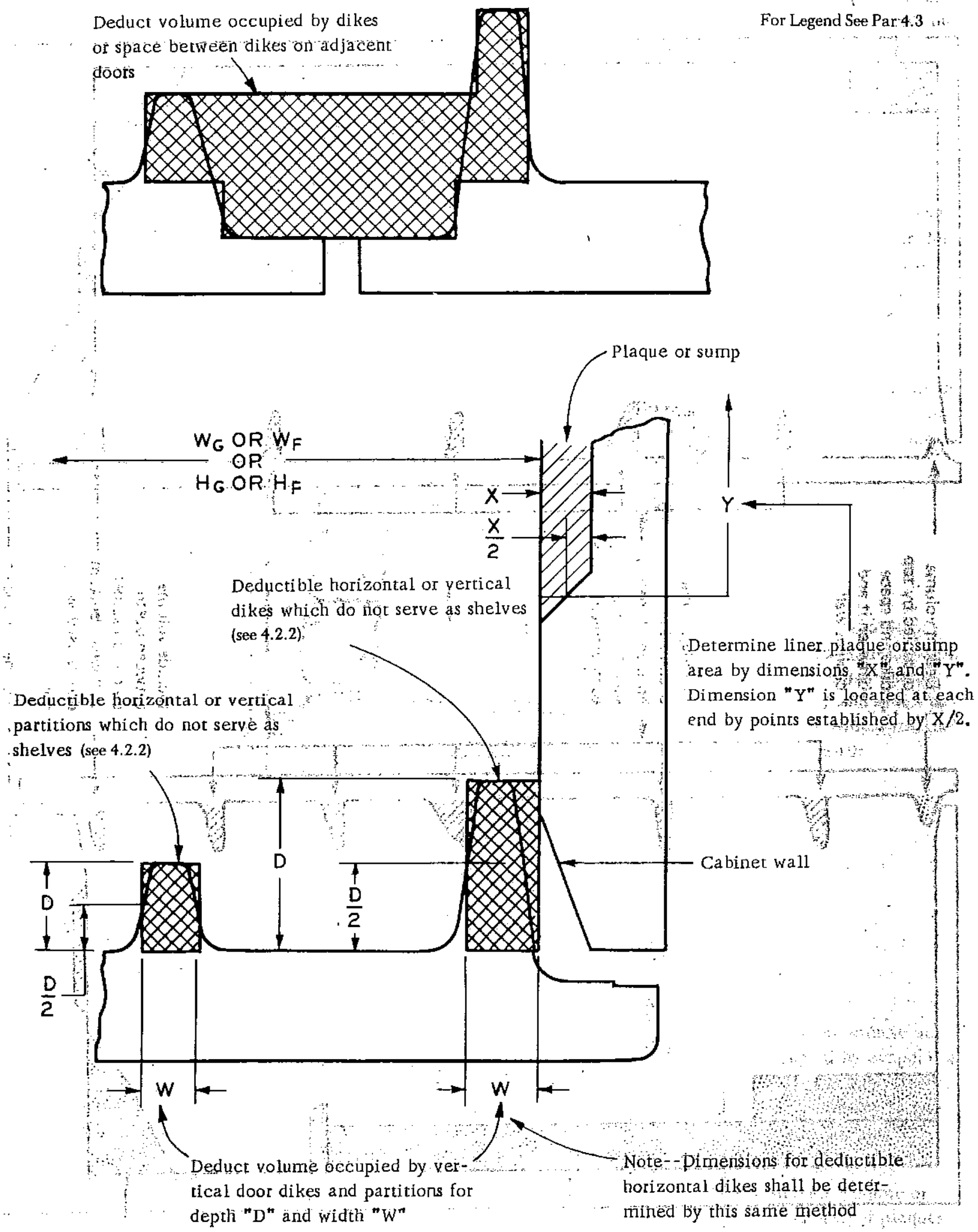
Deduct volume occupied by evaporator, drain trough, drain space, and space between evaporator and liner wall

Deduct volume occupied by projections formed into liner for compressor clearance insulation, etc.

Include volume between bottom dike and cabinet wall when bottom dike is used as a shelf

Include volume of liner plaques and sumps

For Legend See Par 4.3



Deduct volume occupied by dikes or space between dikes on adjacent doors

Plaque or sump

Deductible horizontal or vertical dikes which do not serve as shelves (see 4.2.2)

Determine liner plaque or sump area by dimensions "X" and "Y". Dimension "Y" is located at each end by points established by X/2.

Deductible horizontal or vertical partitions which do not serve as shelves (see 4.2.2)

Cabinet wall

Deduct volume occupied by vertical door dikes and partitions for depth "D" and width "W"

Note--Dimensions for deductible horizontal dikes shall be determined by this same method

Fig. 4-6

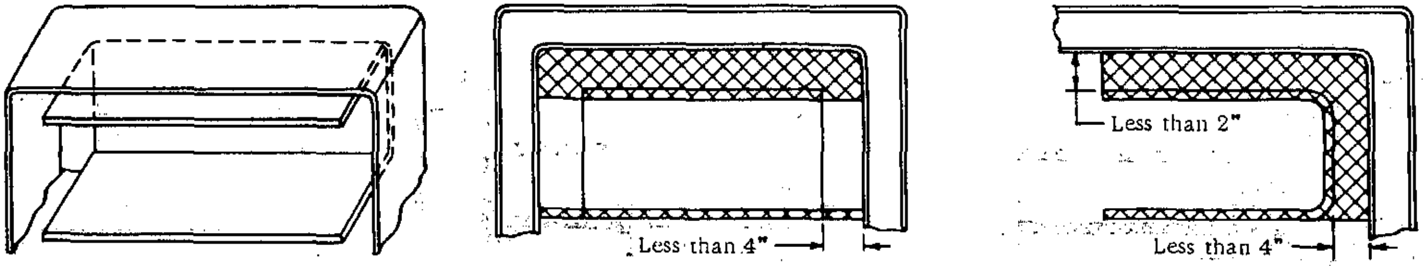
Door Dike and Liner Plaque Dimensions (Total Refrigerated Volume)

For Legend See Par. 4.3

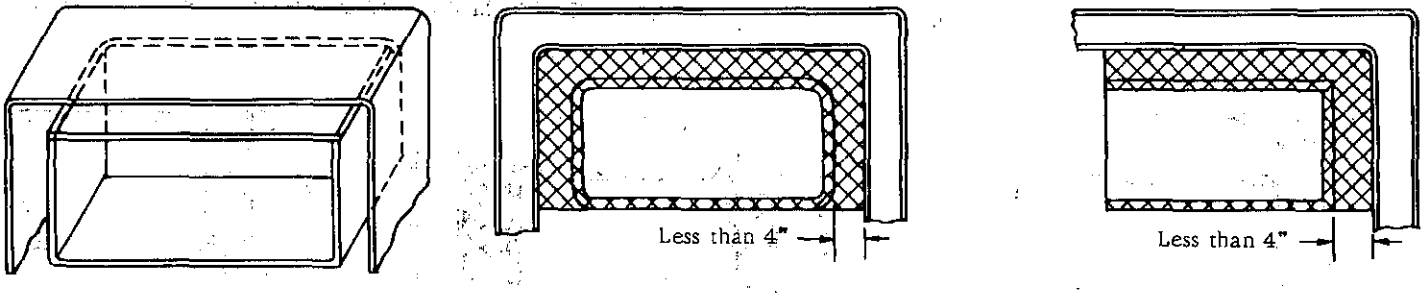
EVAPORATOR WITH OPEN SIDES

Front View

Side View



EVAPORATOR WITH CLOSED TOP, BOTTOM, SIDES AND BACK



EVAPORATOR WITH OPEN BACK

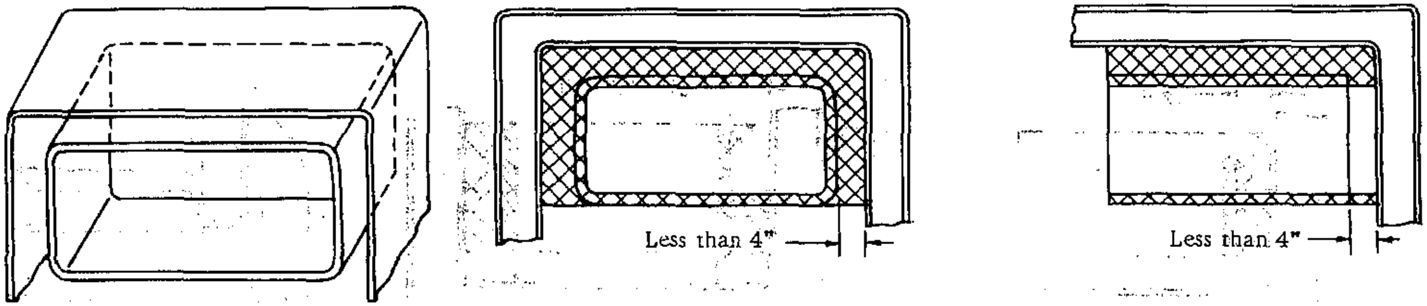
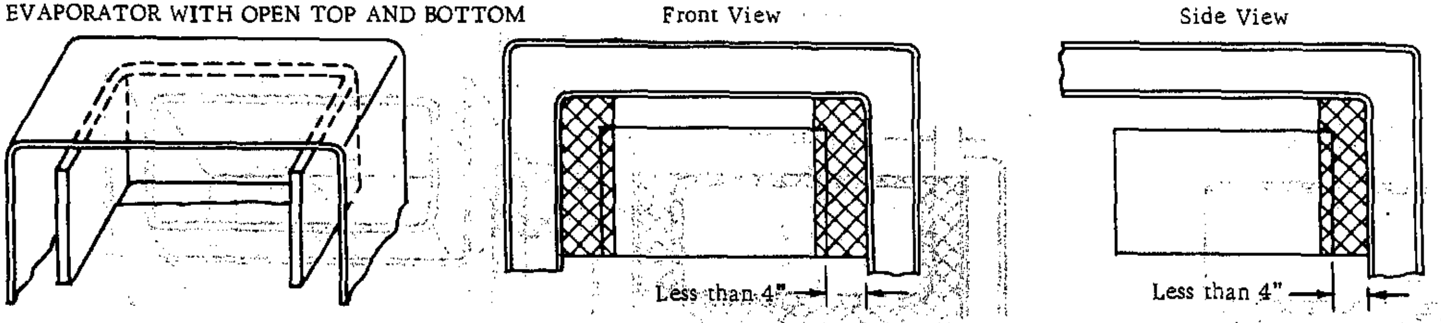


Fig. 4-7

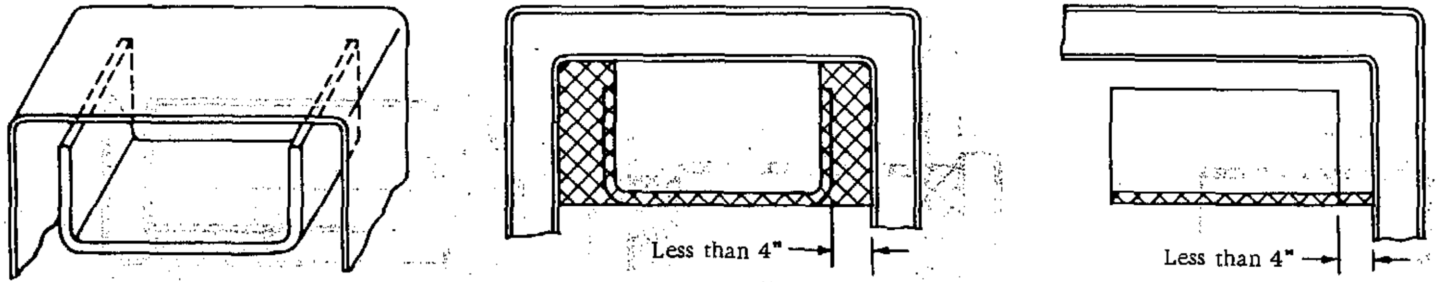
Evaporator Applications (Total Refrigerated Volume)

For Legend See Par. 4.3

EVAPORATOR WITH OPEN TOP AND BOTTOM



EVAPORATOR WITH OPEN TOP AND BACK



EVAPORATOR WITH SHELF, OPEN TOP AND PARTIAL BACK

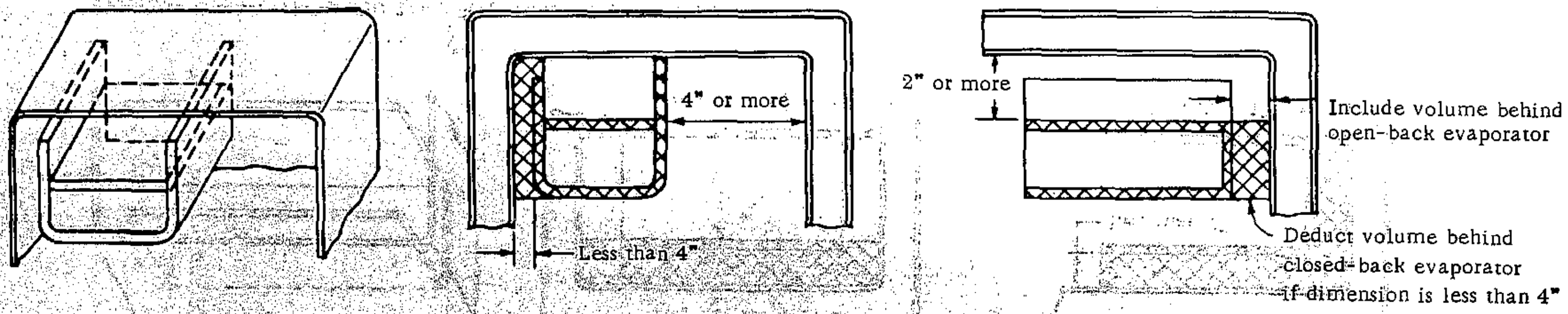

4" or more
Less than 4"
2" or more
Include volume behind open-back evaporator
Deduct volume behind closed-back evaporator if dimension is less than 4"

Fig. 4-7

Evaporator Applications (Total Refrigerated Volume)
(Continued)

For Legend See Par. 4.3

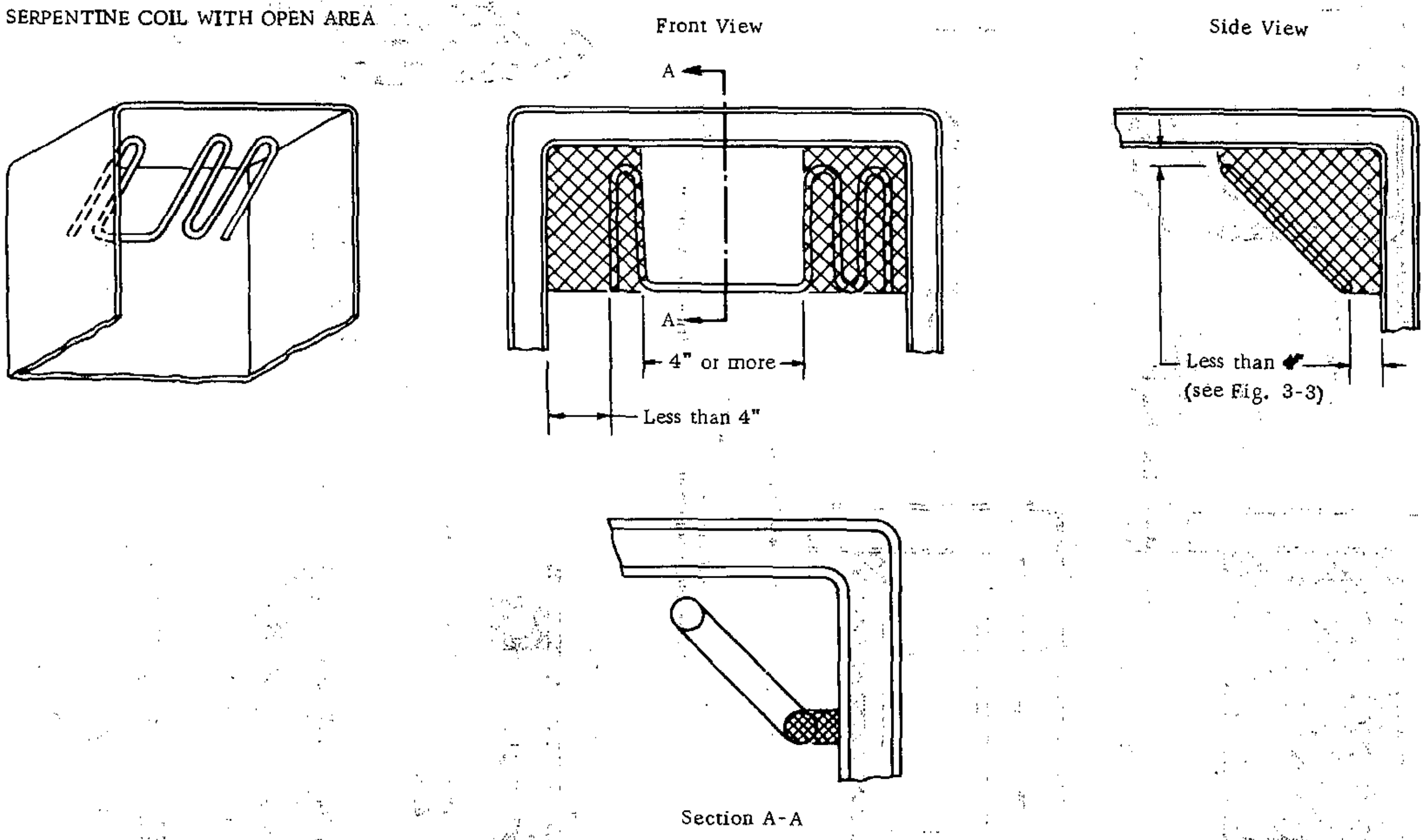


Fig. 4-7

Evaporator Applications (Total Refrigerated Volume)
(Continued)

For Legend See Par. 4.3

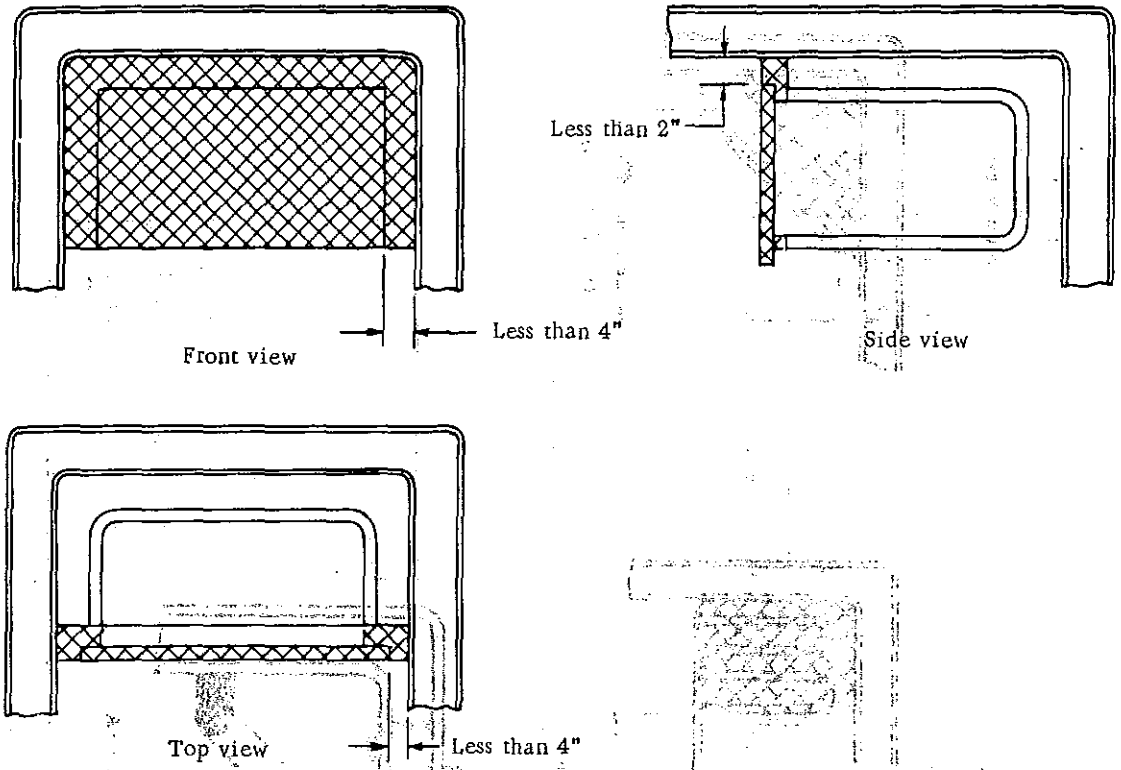


Fig. 4-8

Evaporator Door Deductions (Total Refrigerated Volume)

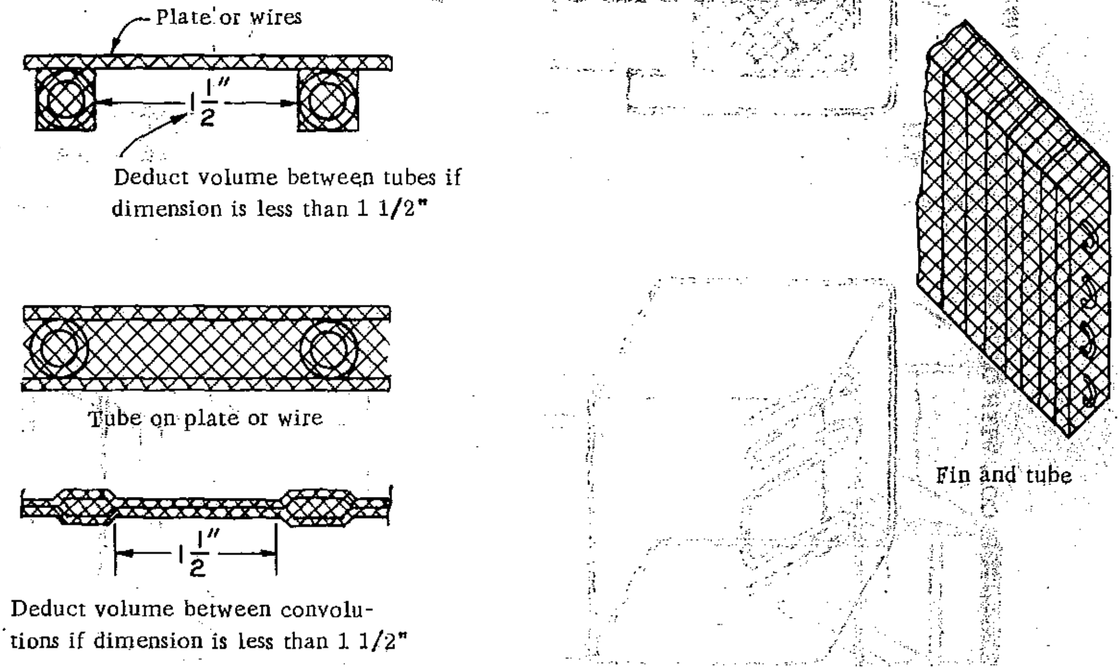


Plate or wires
1 1/2"
Deduct volume between tubes if dimension is less than 1 1/2"
Tube on plate or wire
1 1/2"
Deduct volume between convolutions if dimension is less than 1 1/2"
Fin and tube

Fig. 4-9

Types of Evaporators (Total Refrigerated Volume)

For Legend See Par. 4.3

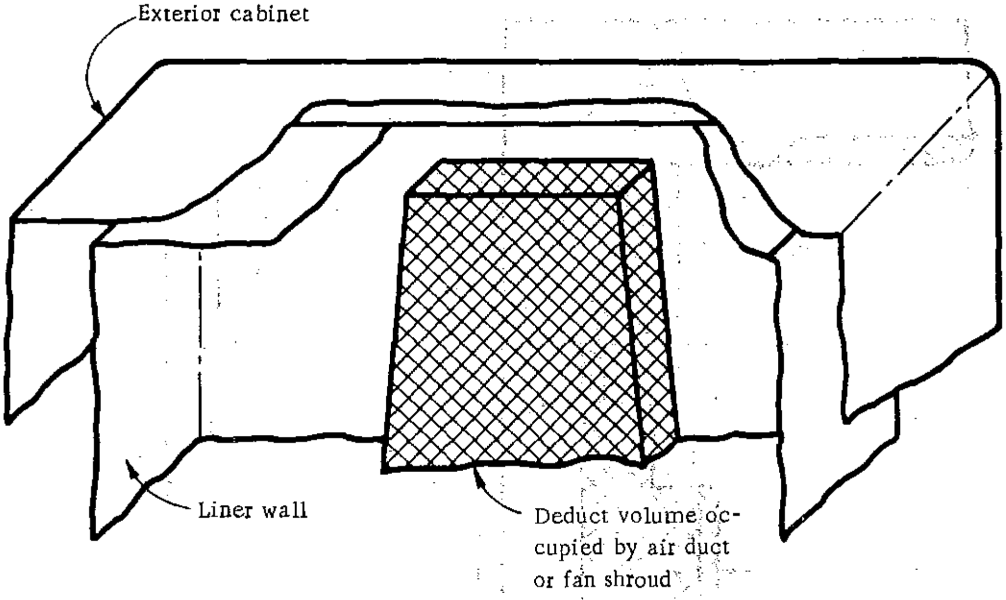


Fig. 4-10

Volume in Freezer Compartment Occupied by Air Duct (Total Refrigerated Volume)

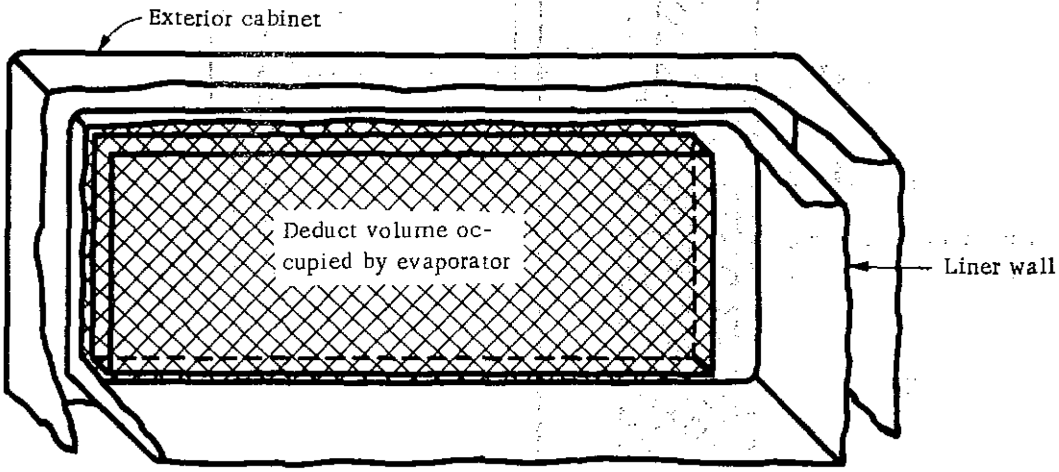
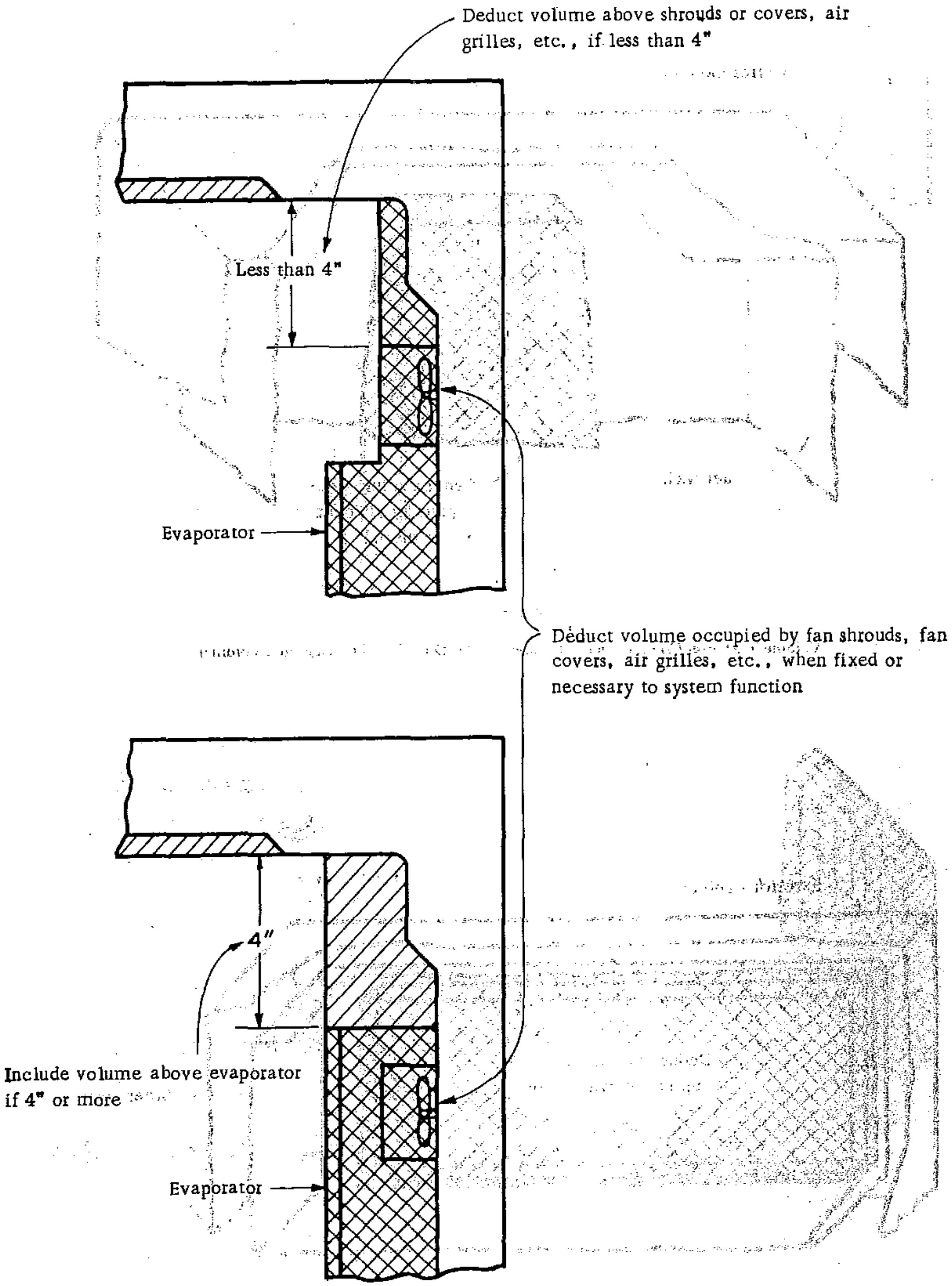


Fig. 4-11

Volume in Freezer Compartment Occupied by Evaporator in Forced-air Systems (Total Refrigerated Volume)

For Legend See Par. 4.3



Deduct volume above shrouds or covers, air grilles, etc., if less than 4"

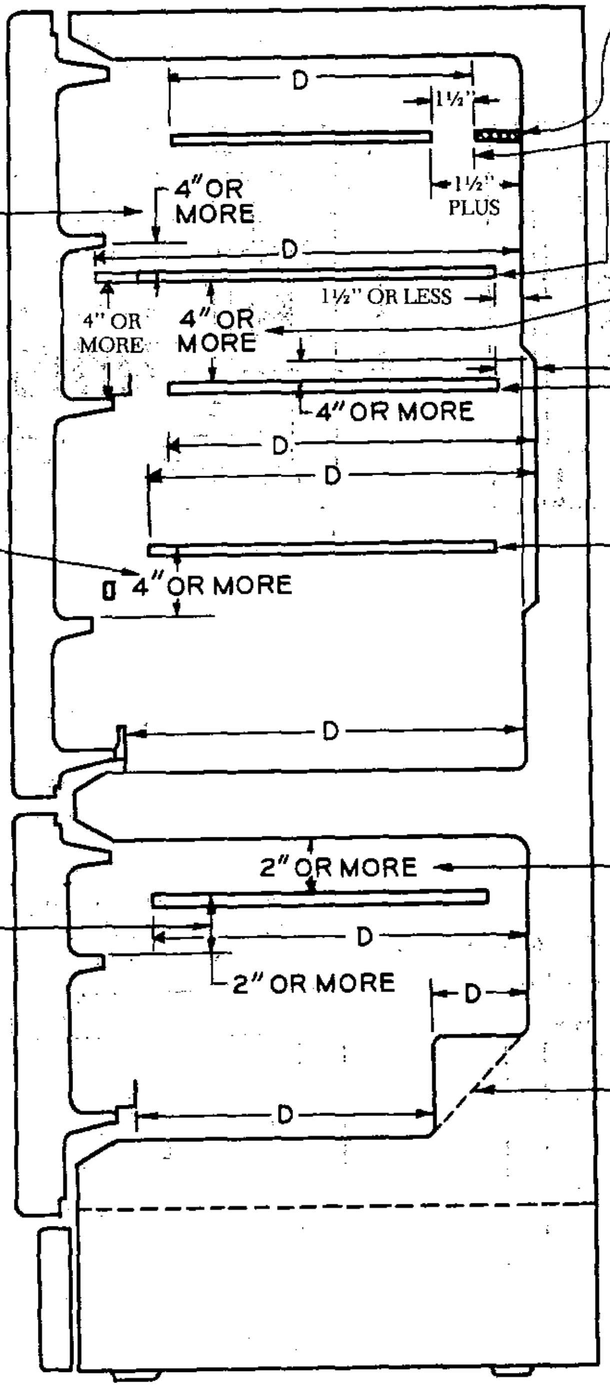
Deduct volume occupied by fan shrouds, fan covers, air grilles, etc., when fixed or necessary to system function

Include volume above evaporator if 4" or more

Fig. 4-12

Volume in Fresh Food Compartment Occupied by Fan Shrouds, Etc. (Total Refrigerated Volume)

For Legend See Par. 4.5



Do not include space beyond 1½" from shelf.

Include space beyond shelf when 1½" or less.

Refrigerator shelf area must have a minimum clearance of 4" above it

1½" OR LESS

Include overhang beyond shelf into plaque*

Do not include area unless there is 4" or more in height between overlapping door shelves and cabinet shelves

Freezer shelf area must have a minimum clearance above it of 2"

Do not include area unless there is 2" or more in height between overlapping door shelves and freezer shelves

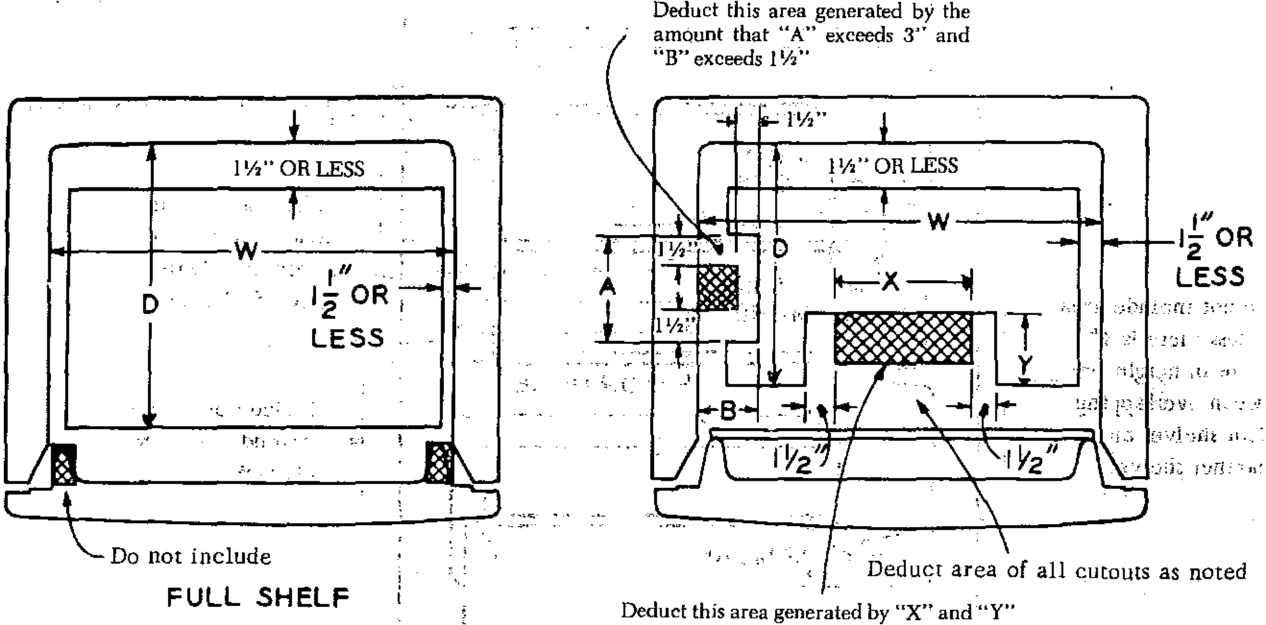
See Fig. 4-16 for beveled liner.

*To be included, any shelf area (except on the doors) must have at least 4" clearance above it in the fresh food compartment and 2" in the freezer compartment. These clearance limitations do not apply to the door shelves (see Fig. 4-14). A maximum overhang of 1½" at the rear of main shelves in the fresh food and freezer compartments may be included in the shelf depth provided the overhang conforms with the 4" and 2" clearance limitations.

Fig. 4-13

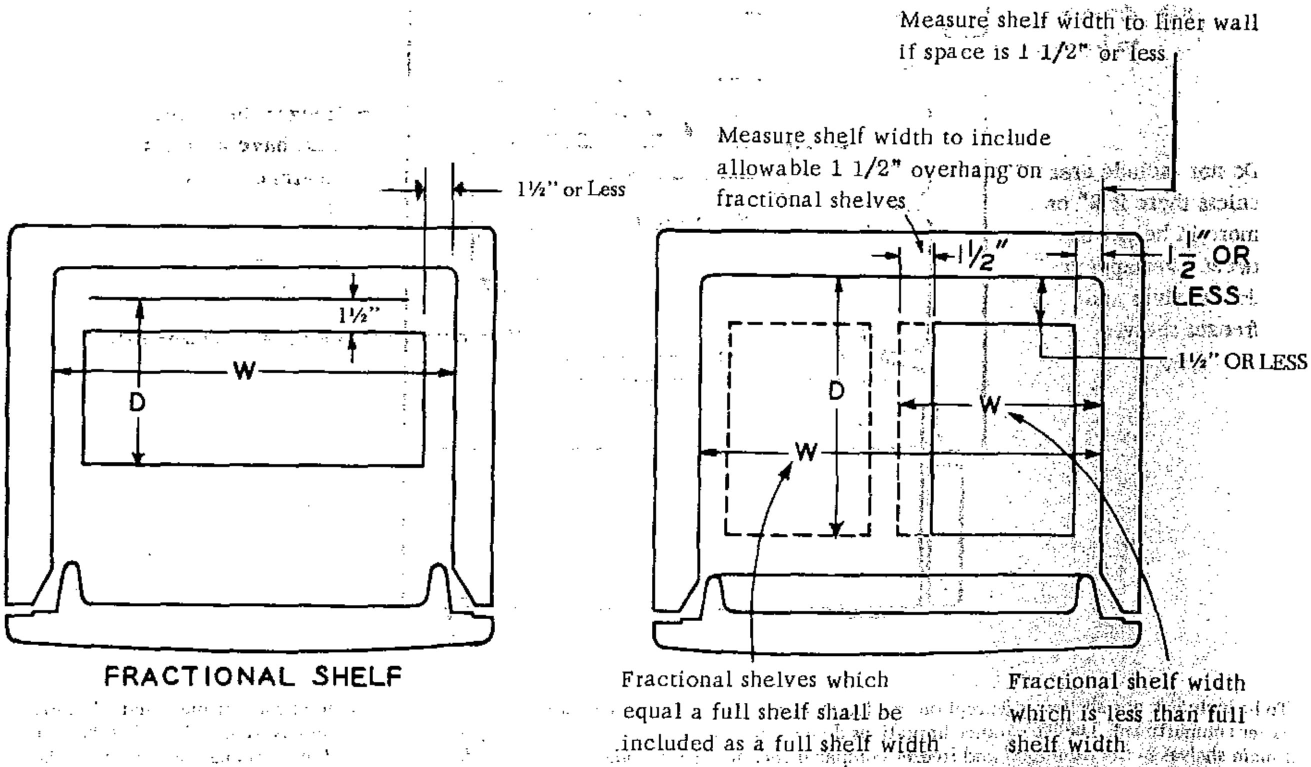
Shelf Clearance Requirements (Total Shelf Area)

For Legend See Par. 4.5


Deduct this area generated by the amount that "A" exceeds 3" and "B" exceeds 1½"
1½" OR LESS
W
D
1½" OR LESS
Do not include
1½"
1½" OR LESS
W
1½" OR LESS
1½"
1½"
A
D
X
Y
B
1½"
1½"
Deduct area of all cutouts as noted
Deduct this area generated by "X" and "Y"

FULL SHELF

CUT-OUT SHELF


Measure shelf width to liner wall if space is 1 1/2" or less
1½" or Less
Measure shelf width to include allowable 1 1/2" overhang on fractional shelves
1½"
D
W
1½"
1½" OR LESS
1½" OR LESS
D
W
W
Fractional shelves which equal a full shelf shall be included as a full shelf width
Fractional shelf width which is less than full shelf width

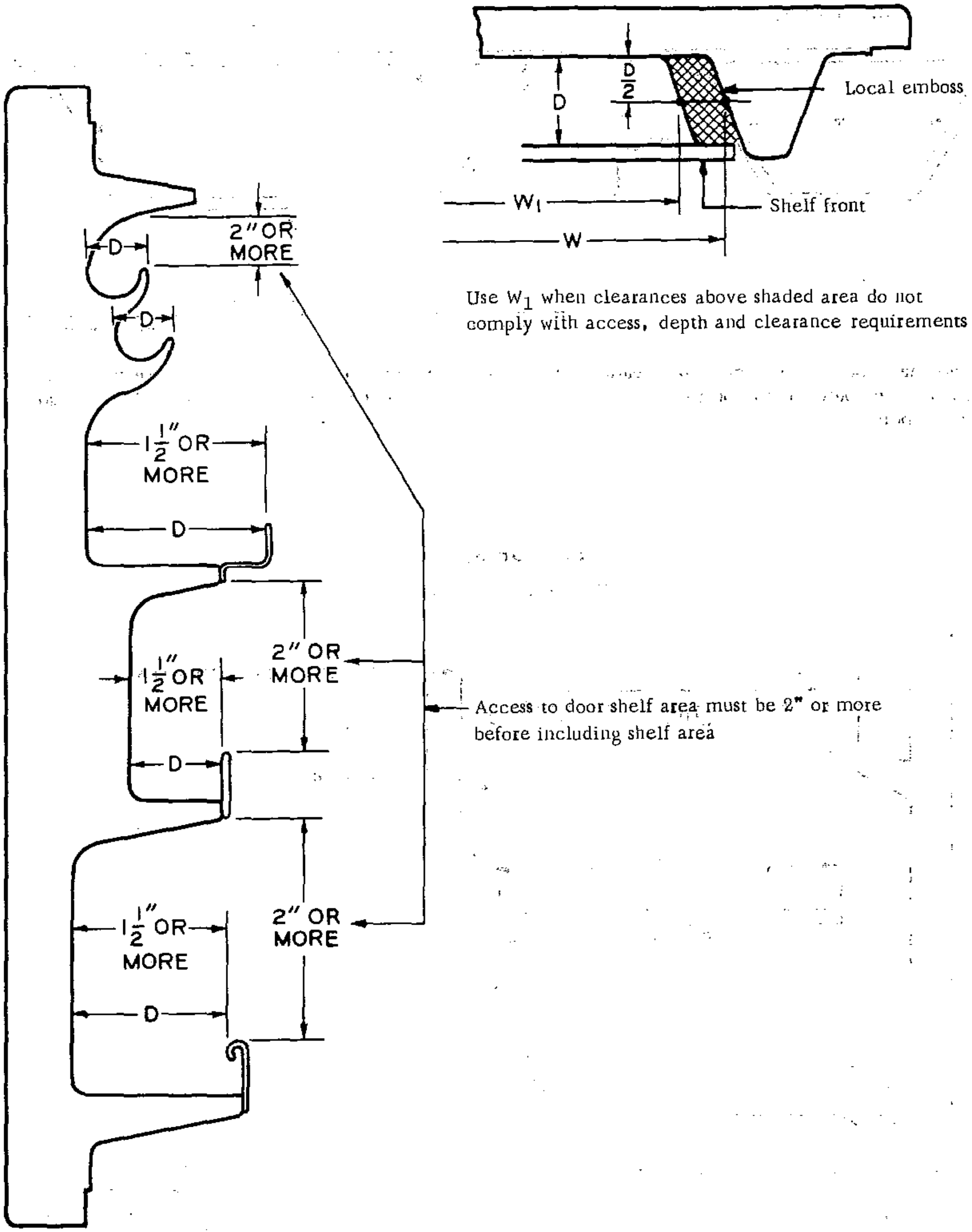
FRACTIONAL SHELF

FRACTIONAL SHELVES

Fig. 4-14

Width and Depth Requirements (Total Shelf Area)

For Legend See Par. 4.5



Use W_1 when clearances above shaded area do not comply with access, depth and clearance requirements

Access to door shelf area must be 2" or more before including shelf area

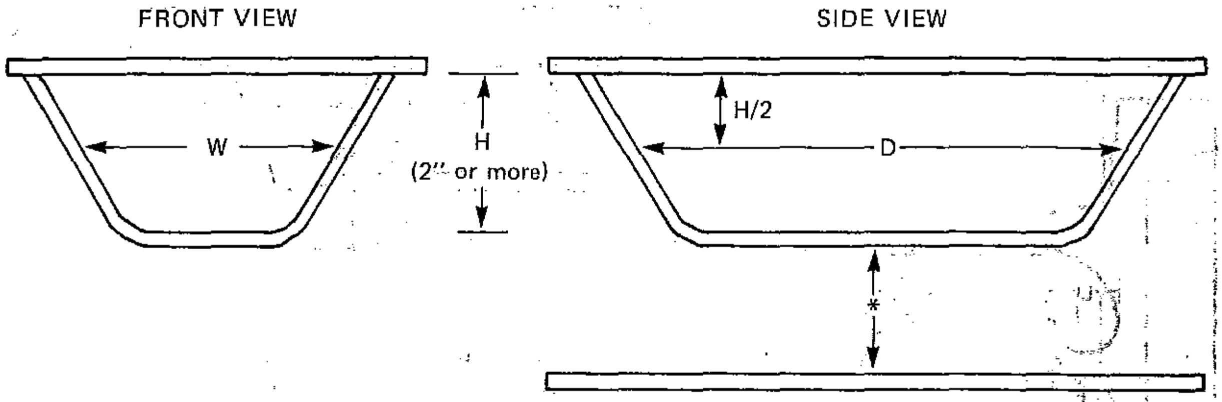
Fig. 4-15

Doors (Total Shelf Area)

For Legend See Par. 4.5

FIGURE 4–16

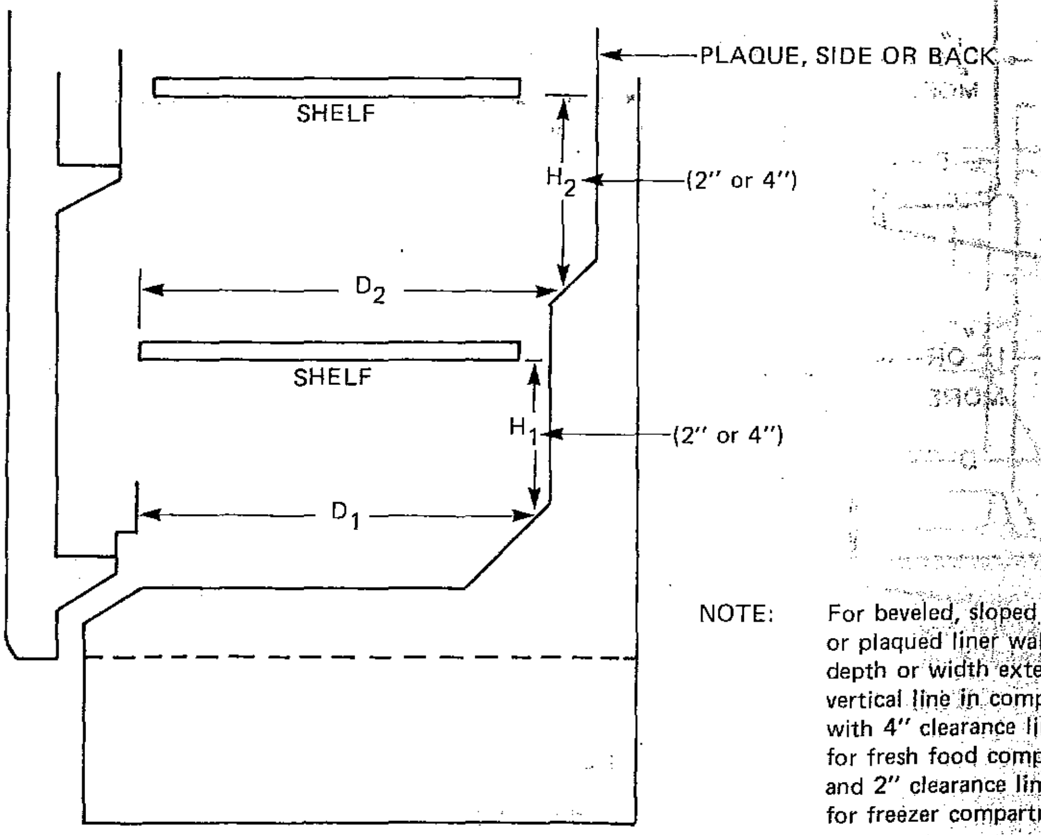
Suspended Containers (Total Shelf Area)



*There must be a minimum of 4" clearance in a fresh food compartment and 2" clearance in a freezer compartment between the bottom of a suspended container and the shelf beneath it to include the shelf area of both.

FIGURE 4–17

Beveled Liner Surfaces



NOTE: For beveled, sloped bottoms, or plaqued liner walls, use depth or width extended to vertical line in compliance with 4" clearance limitation for fresh food compartment and 2" clearance limitation for freezer compartment.

(a) Volume occupied by parts necessary for the proper functioning of the unit, such as cooling coils, evaporators, air duct, drip trough, baffles, and fan shrouds.

(b) Volume occupied by door dikes which do not serve as shelves.

(c) Volume occupied by partitions and projections within the door(s) enclosing a compartment which do not serve as shelves and which, collectively, exceeds a volume of more than 0.05 cubic foot (1.4 liters).

(d) Volume between the deductible door dikes (see Paragraph 5.2.1.2b) and cabinet breaker strips or adjacent liner walls.

(e) Volume occupied by fixed projections, such as control knobs, shelf hangers, shelf and basket rails, and thermostat escutcheons, which collectively, exceeds a volume of more than 0.05 cubic foot (1.4 liters) per compartment.

5.2.2 Method of Computation.

5.2.2.1 All linear dimensions are to be measured to the nearest 1/16 inch (nearest 0.2 cm).

5.2.2.2 Divide the total refrigerated volume into various sections having similar width and depth dimensions (see Figures 5-1 through 5-5).

5.2.2.3 Calculate the volume of each section and the volume of all shaded spaces shown in Figures 5-1 through 5-6. Summate the volumes of the sections to determine the total unadjusted refrigerated volume.

5.2.2.4 Deduct from the total unadjusted refrigerated volume those items listed in Paragraph 5.2.1.2 and shown with double cross-hatching in Figures 5-1 through 5-9 in order to determine the total refrigerated volume.

5.2.3 Data To Be Reported. The total refrigerated volume is to be reported to the nearest 0.1 cubic foot (1 liter).

5.3 Legend for Figures 5-1 through 5-9. Figures 5-1 through 5-9 show typical freezers and are not intended to cover all design variations. However, a combination of components from the various figures may be used for specific designs.

The dimension symbols used in the figures are:

H — Height of compartment.

W — Width of compartment.

D — Depth of compartment.

D_4 — Subscript numerals are typical of section variations used to compute individual volumes.

The cross-hatching used in the figures indicate:

▨ — Volume to be included.

▩ — Volume to be deducted.

5.4 Total Shelf Area (Vertical Freezer) (see Paragraph 3.15).

5.4.1 Area.

5.4.1.1 The total shelf area is to be determined from the areas of the main shelves, door shelves, bottoms of suspended containers or dispensers, and the bottom of the liner(s).

5.4.2 Clearances. The area of any part of a shelf which has less than 2 inches (5.1 cm) clearance above the shelf is not to be included in the total shelf area, except on the door or as otherwise provided in Paragraph 5.4.3.

5.4.3 Method of Computation.

5.4.3.1 Units of Measurements. All linear dimensions are to be measured to the nearest 1/16 inch (nearest 0.2 cm).

5.4.3.2 Cabinet Shelves.

5.4.3.2.1 Full Shelves and Liners. The area of the full shelves and of the bottom of the liner(s) is to be the product of the mean depth and mean width as shown in Figures 5-10 and 5-11.

If the bottom of the liner(s) cannot qualify as a full shelf, its area is to be computed as the area of a cutout shelf or a fractional shelf.

The depth dimension used for computing the shelf area is to be measured from the front of the shelf. (See Figures 5-10 and 5-11.)

The depth of the shelf is to be the distance from the front edge of the shelf to the rear liner or to a point 1½ inches (3.8 cm) beyond the shelf, whichever is less (see Figures 5-10 and 5-11).

The width of a shelf is to be measured to the liner side(s) or to a point 1½ inches (3.8 cm) beyond the shelf edge, whichever is less (see Figure 5-11).

5.4.3.2.2 Fractional Shelves. The area of fractional shelves is to be the product of the width and depth, including the allowable overhang, and is to be determined in accordance with Paragraph 5.4.3.2.1 and Figure 5-11.

5.4.3.2.3 Cutout Shelves. When any part of a full shelf or a fractional shelf is cut out, the area of the cutout which exceeds the allowable overhang as determined in accordance with Paragraph 5.4.3.2.1 is to be deducted from the calculated shelf area (see Figure 5-11).

5.4.3.3 Door Shelves. The area of door shelves is to be the product of the mean depth and mean width of the shelf. The area of any part of a door shelf having an access clearance of less than 2 inches (5.1 cm) is not to be included in the net shelf area (see Figures 5-10 and 5-12).

5.4.3.4 Suspended Containers. The area of the bottom of suspended containers is to be included in the net shelf area provided there is a minimum clearance of 2 inches (5.1 cm) above the bottom of the containers. (See Figure 5-13.)

5.4.4 Data To Be Reported. The net shelf area is to be reported to the nearest 0.1 square foot (nearest 100 square centimeters).

5.5 Legend for Figures 5-10 through 5-14. Figures 5-10 through 5-14 show typical shelf configurations for Household Freezers and are not intended to cover all design variations. However, a combination of components from the various figures may be used for specific designs.

The dimension symbols used in the figures are:

H — Height of compartment.

W — Width of compartment.

D — Depth of compartment.

D_4 — Subscript numerals are typical of section variations used to compute individual areas.

The cross-hatching used in the figures indicates:

▨ — Area to be deducted.

6. METHOD FOR COMPUTING THE VOLUME OF SPECIAL FEATURES OF HOUSEHOLD REFRIGERATORS AND HOUSEHOLD FREEZERS

6.1 Scope of Section 6. This section describes methods for measuring the space occupied by and the space provided by special features occupying volume within the total refrigerated volume of household refrigerators and household freezers.

6.2 Special Features.

6.2.1 Special features to be included for household refrigerators are for example: baskets, crispers, meat pans, chiller trays, water coolers, can or package racks, movable compartments such as drawers or trays and ice makers (including storage bins).

6.2.2 Special features to be included for household freezers are for example: baskets, pan or package racks, ice makers (including storage bins) and movable compartments such as drawers or trays.

6.2.3 Door features of household refrigerators and household freezers such as shelves, racks, rails, retainers, or any component that is attached or formed into the door liner and intended to improve its utility for storing jars, cans and packages, are not to be included in the category of a special feature that requires volume considerations.

Special features located in the door, such as crispers, liquid or ice dispensers, compartment doors, etc., are to be included in the volume calculations.

6.2.4 A free-standing special feature is one which rests freely on a shelf or on a storage compartment bottom such as an ice tray or a set-in pan.

6.2.5 A supported-fixed special feature is one which is supported in a fixed location such as an automatic ice maker or a chiller tray.

6.2.6 A supported-relocatable special feature is one which is supported in a location chosen by the user such as a meat pan or an egg container.

6.2.7 Storage Volume Occupied by Special Features (see Figures 6-1 and 6-2).

6.2.7.1 Free-Standing Special Features. Calculate the volume occupied by free-standing special features on an individual basis as the product of the values of width, length and height of an encompassing right angle envelope for each feature. When special features are adjacent to each other, do not include volume between them more than once. Measure all linear dimensions to the nearest 1/16 inch (.2 cm).

6.2.7.2 Supported-Fixed Special Features. Calculate the volume occupied by supported-fixed special features on an individual basis as the product of adjusted values of width, length and height of each feature. These adjusted values are the actual average exterior dimensions of the feature, increased by the distances to adjacent surfaces or shelves where the volume defined by the distances is not readily accessible for normal use. A volume not readily accessible for normal use is defined as volume which is accessible only by removal of parts from the cabinet.

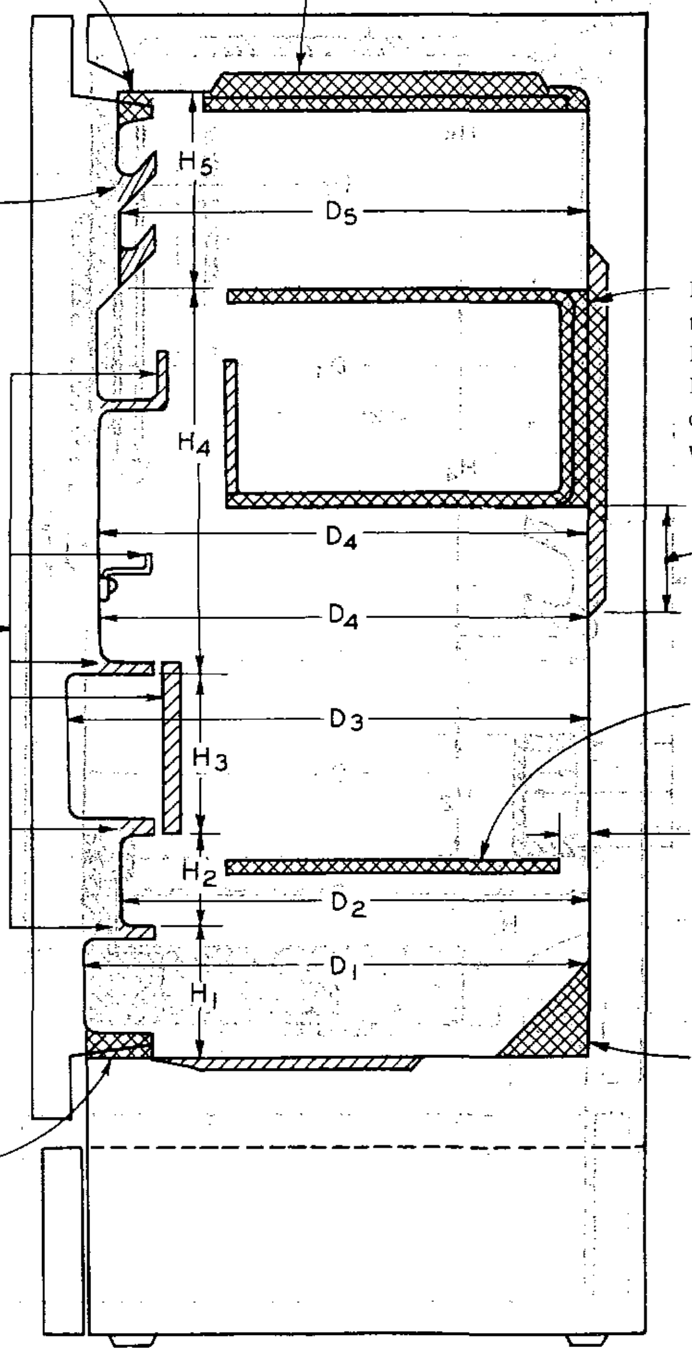
A volume adjacent to a special feature which has a dimension of less than 4 inches (10.2 cm) in the case of a fresh food compartment, or less than 2 inches (5.1 cm) in the case of a freezer compartment, is considered as not readily accessible for normal use unless specific means are provided for supporting stored articles and preventing their interference in the operation of the special feature.

In the case of ice makers or other features where the volume occupied by the feature is defined in part by the movements of parts associated with the mechanical operation of the feature, the adjusted value of width and length shall include the maximum dimension(s) required by the path of the moving part(s), increased by the distances to adjacent surfaces or shelves where the volume defined by these distances is not readily accessible for normal use. This includes the dimensions of any volume that is not readily accessible for normal use.

6.2.7.3 Supported-Relocatable Special Features. Calculate the volume occupied by supported-relocatable special features on an individual basis as the product of adjusted values of width, length and height of each feature with the feature located in the position occupying the least volume.

6.2.7.4 Data To Be Reported. Report the sum of

For Legend See Par. 5.3



Deduct volume occupied by top dike and space between it and cabinet wall (see Fig. 5-6)

Deduct volume between evaporator top and liner top unless 2" or more and is recommended by manufacturer as freezer total refrigerated volume.

Include volume occupied by juice can shelves or racks

Deduct volume between evaporator and liner rear walls if less than 4" or evaporator and liner side walls if less than 1 1/2"

Deduct volume below or above evaporator if less than 2"

Include volume occupied by horizontal shelves, shelf fronts or compartment doors

Deduct volume occupied by evaporator (see Fig. 5-7)

Deduct volume between refrigerated shelf and liner sides and rear walls if less than 1 1/2"

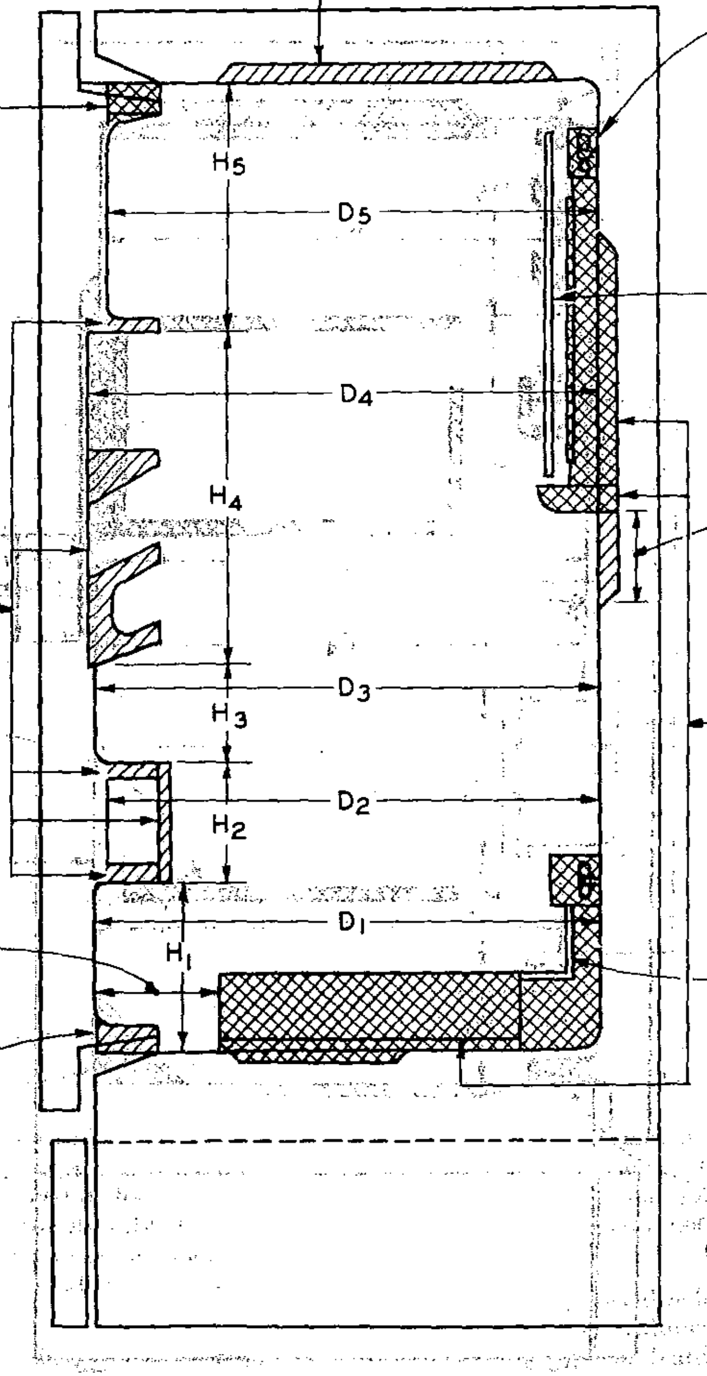
Deduct the bottom dike or the volume between it and cabinet wall when bottom dike is not used as a shelf (see Fig. 5-6)

Deduct volume occupied by projections formed into liner for compressor clearance, insulation, etc.

Fig. 5-1

Household Freezer (Total Refrigerated Volume) — Upright Type

For Legend See Par. 5.3



Include volume of shaded liner plaques and sumps (see Fig. 5-6)

Deduct volume occupied by top dike and space between it and cabinet wall (see Fig. 5-6)

Deduct volume occupied by fan shrouds, fan covers, air grilles, etc., when fixed or necessary to system function (see Fig. 5-8 and 5-9)

Include volume occupied by evaporator shrouds which are nonfunctional and removable

Include volume occupied by juice can shelves or racks, horizontal shelves, shelf fronts or compartment doors

Include volume above or below evaporator if 2" or more

Deduct volume occupied by evaporator, drain trough, drain space, and space between evaporator and liner wall

Include volume between interior door panel and evaporator if 2" or more providing there are shelves on the door

Deduct volume occupied by evaporator shrouds when fixed or necessary to system function

Include volume between bottom dike and cabinet wall when bottom dike is used as a shelf (see Fig. 5-6)

Fig. 5-2

Household Freezer (Total Refrigerated Volume) — Upright Type

For Legend See Par. 5.3

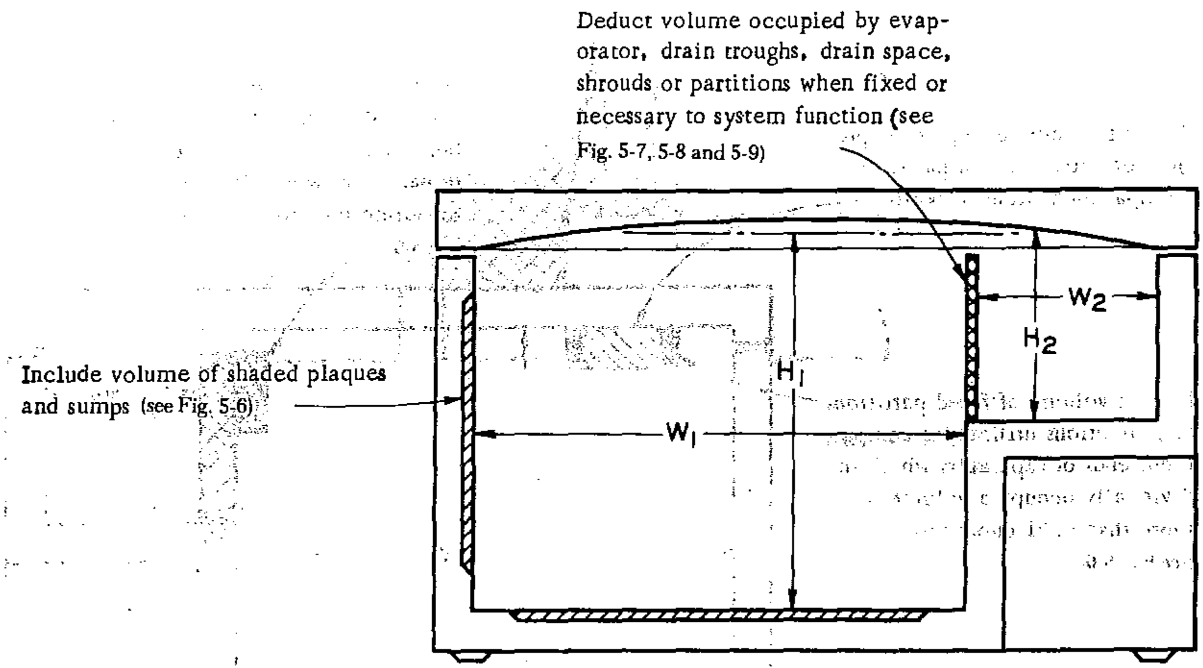

Deduct volume occupied by evaporator, drain troughs, drain space, shrouds or partitions when fixed or necessary to system function (see Fig. 5-7, 5-8 and 5-9)
Include volume of shaded plaques and sumps (see Fig. 5-6)
W1
H1
W2
H2

Fig. 5-3

Household Freezer (Total Refrigerated Volume) — Chest Type

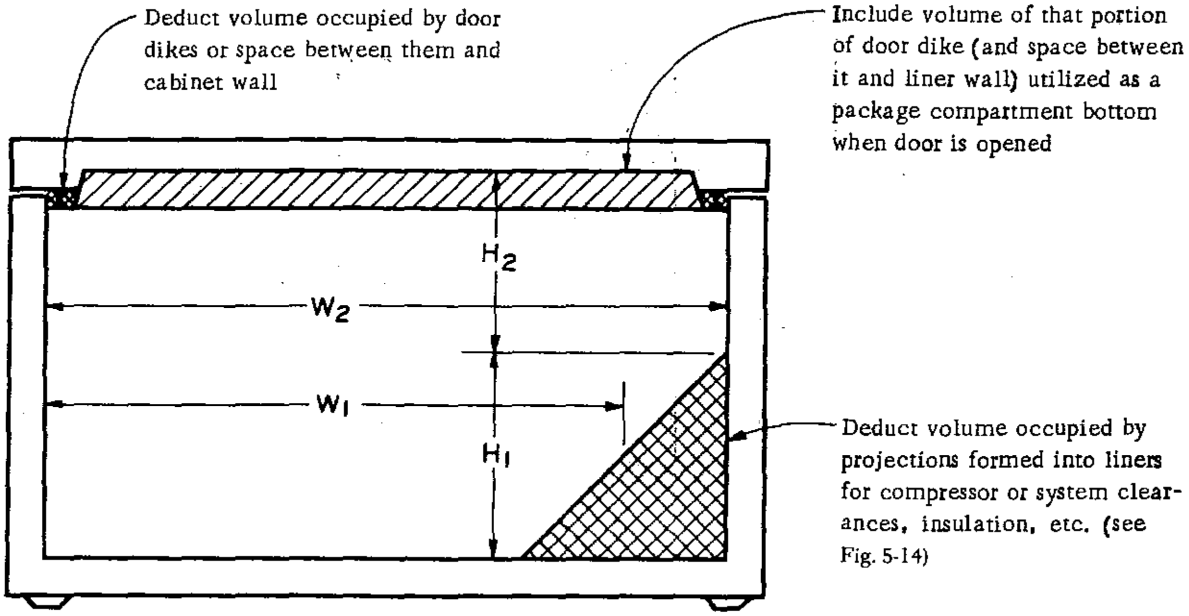
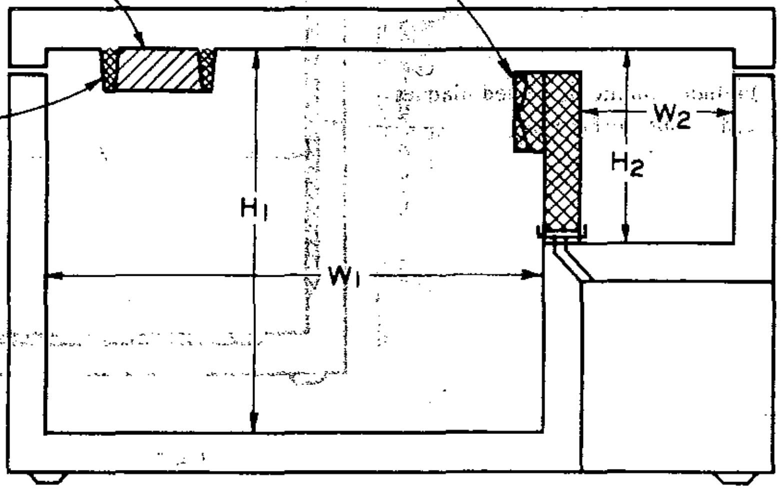

Deduct volume occupied by door dikes or space between them and cabinet wall
Include volume of that portion of door dike (and space between it and liner wall) utilized as a package compartment bottom when door is opened
H2
W2
W1
H1
Deduct volume occupied by projections formed into liners for compressor or system clearances, insulation, etc. (see Fig. 5-14)

Fig. 5-4

Household Freezer (Total Refrigerated Volume) — Chest Type

For Legend See Par. 5.3



Include volume occupied by projections utilized as a package compartment front or bottom

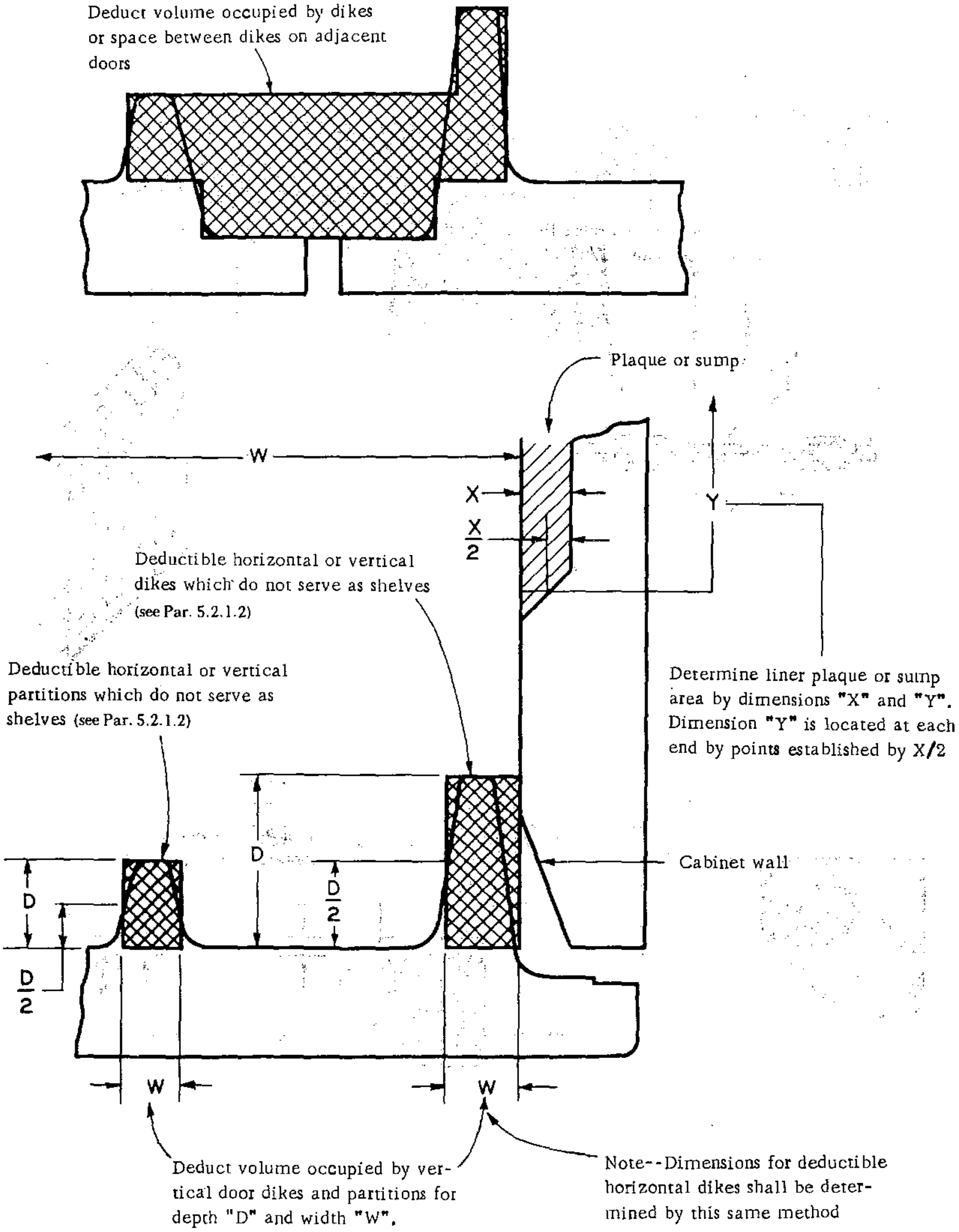
Deduct volume occupied by evaporator, drain trough, drain space, fans, fan covers, air grilles, shrouds or partitions when fixed or necessary to system function (See Fig. 5-8 and 5-9)

Deduct volume of fixed partitions or projections utilized as compartment ends or separators which individually occupy a volume of more than 0. 01 cubic foot (see Fig. 5-6)

Fig. 5-5

Household Freezer (Total Refrigerated Volume) — Chest Type

For Legend See Par. 5.3



Deduct volume occupied by dikes or space between dikes on adjacent doors

Plaque or sump

Deductible horizontal or vertical dikes which do not serve as shelves (see Par. 5.2.1.2)

Deductible horizontal or vertical partitions which do not serve as shelves (see Par. 5.2.1.2)

Determine liner plaque or sump area by dimensions "X" and "Y". Dimension "Y" is located at each end by points established by X/2

Cabinet wall

Deduct volume occupied by vertical door dikes and partitions for depth "D" and width "W".

Note--Dimensions for deductible horizontal dikes shall be determined by this same method

Fig. 5-6

Door Dike and Liner Plaque Dimensions (Total Refrigerated Volume)

For Legend See Par. 5.3

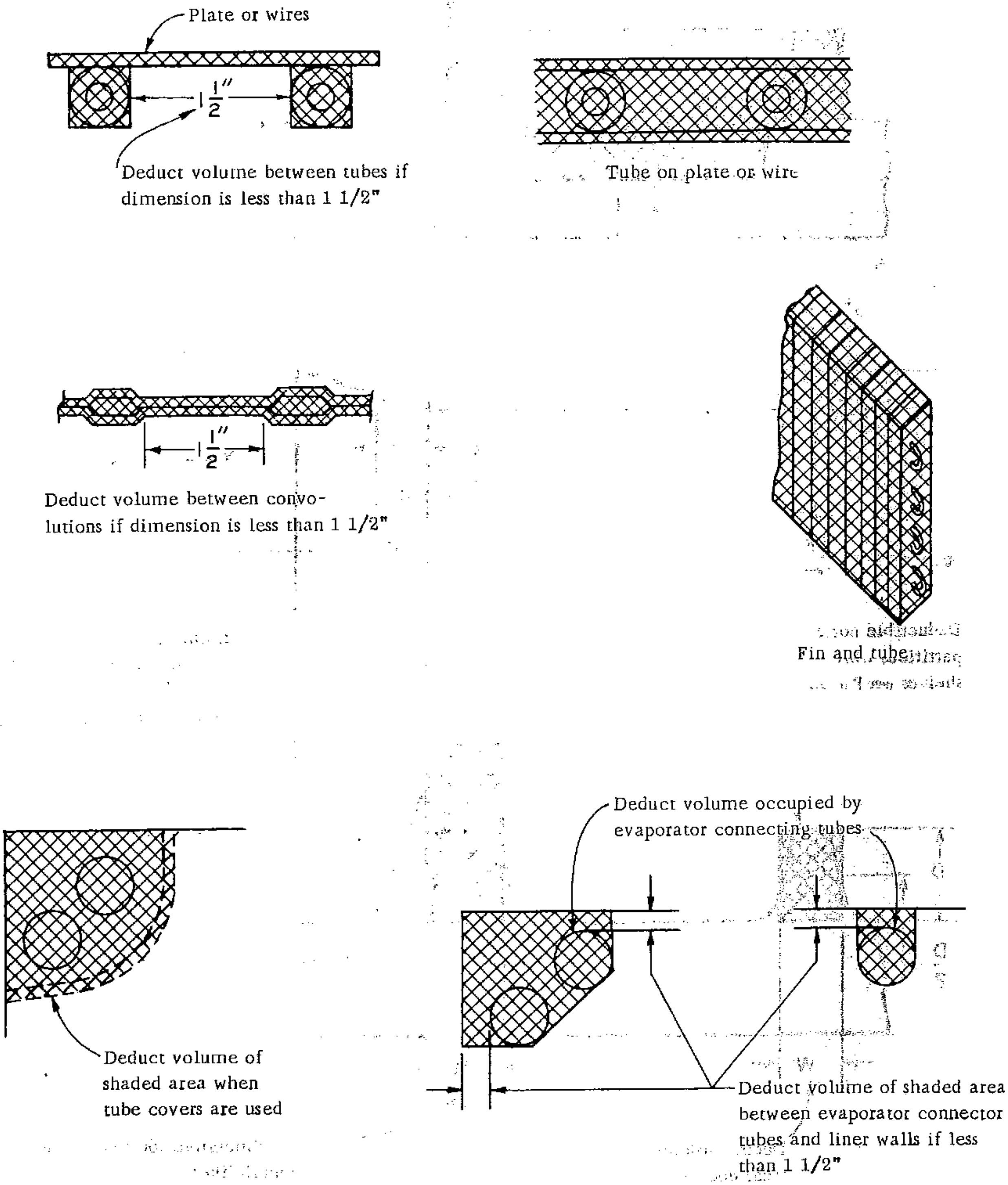


Plate or wires
$1\frac{1}{2}''$
Deduct volume between tubes if dimension is less than 1 1/2"
Tube on plate or wire
$1\frac{1}{2}''$
Deduct volume between convolutions if dimension is less than 1 1/2"
Fin and tube
Deduct volume of shaded area when tube covers are used
Deduct volume occupied by evaporator connecting tubes
Deduct volume of shaded area between evaporator connector tubes and liner walls if less than 1 1/2"

Fig. 5-7

Types of Evaporators (Total Refrigerated Volume)

For Legend See Par. 5.3

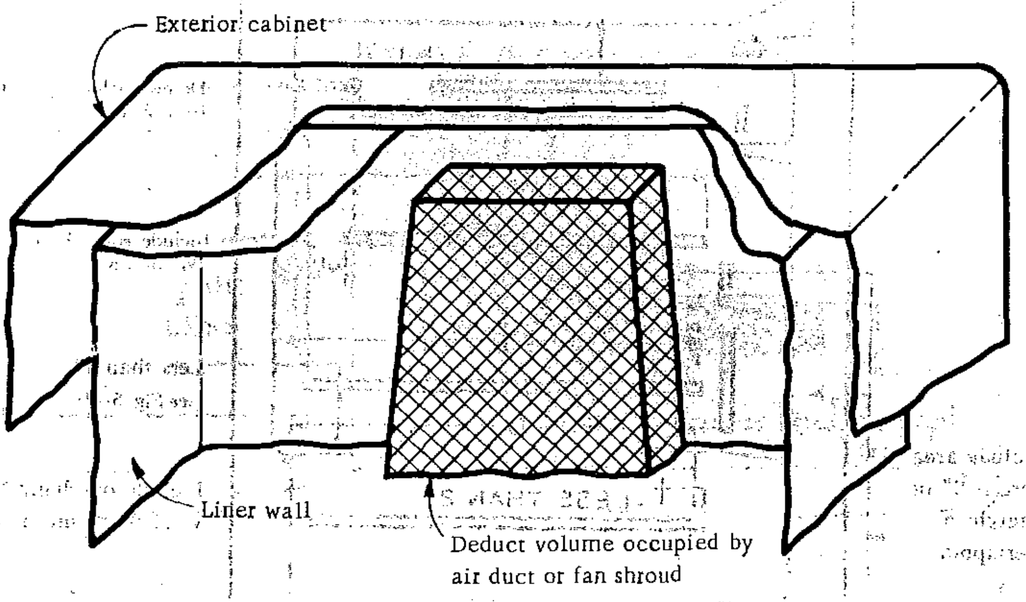


Fig. 5-8

Volume Occupied by Air Duct (Total Refrigerated Volume)

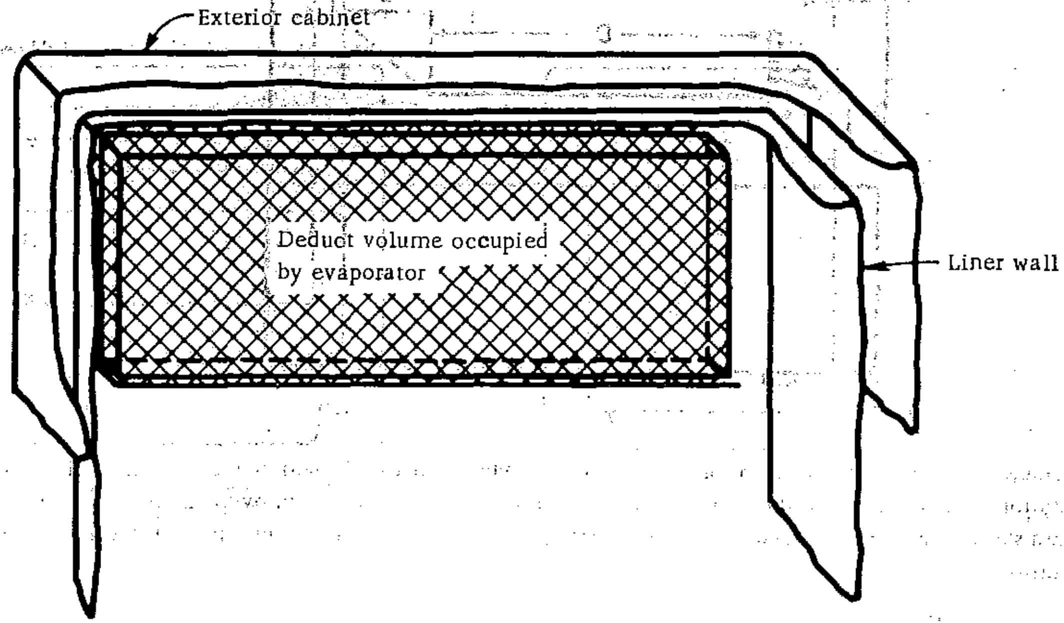
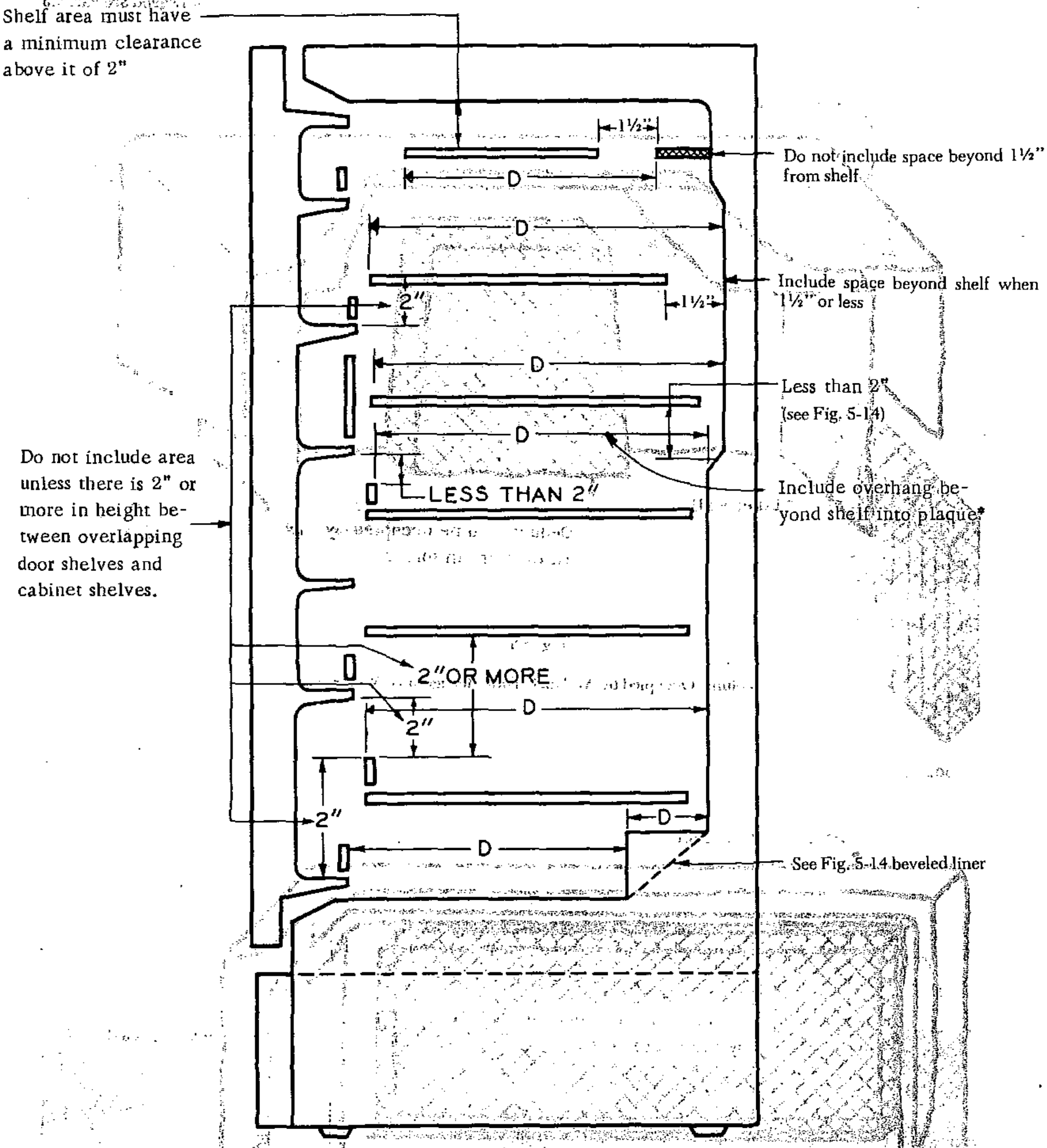


Fig. 5-9

Volume Occupied by Evaporator in Forced-air Systems (Total Refrigerated Volume)

For Legend See Par. 5.5

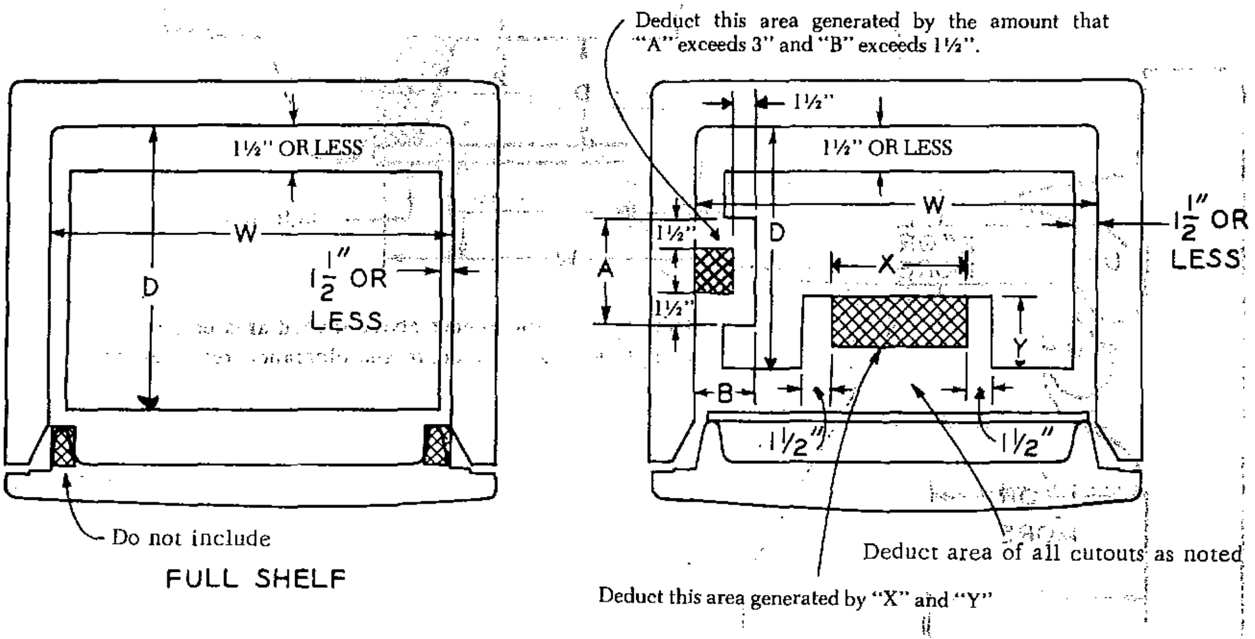

Shelf area must have a minimum clearance above it of 2"
1½"
Do not include space beyond 1½" from shelf
D
D
Include space beyond shelf when 1½" or less
2"
1½"
D
Less than 2" (see Fig. 5-14)
D
LESS THAN 2"
Include overhang beyond shelf into plaque*
Do not include area unless there is 2" or more in height between overlapping door shelves and cabinet shelves.
2" OR MORE
D
2"
2"
D
D
See Fig. 5-14 beveled liner

*To be included, any shelf area (except on the doors) must have at least 2" clearance above it. This clearance limitation does not apply to the door shelves. (see Fig. 5-12) A maximum overhang of 1½ in front or rear of main shelves may be included in the shelf depth provided the overhang conforms with the 2" clearance limitation.

Fig. 5-10

Shelf Clearance Requirements (Total Shelf Area)

For Legend See Par. 5.5



Do not include

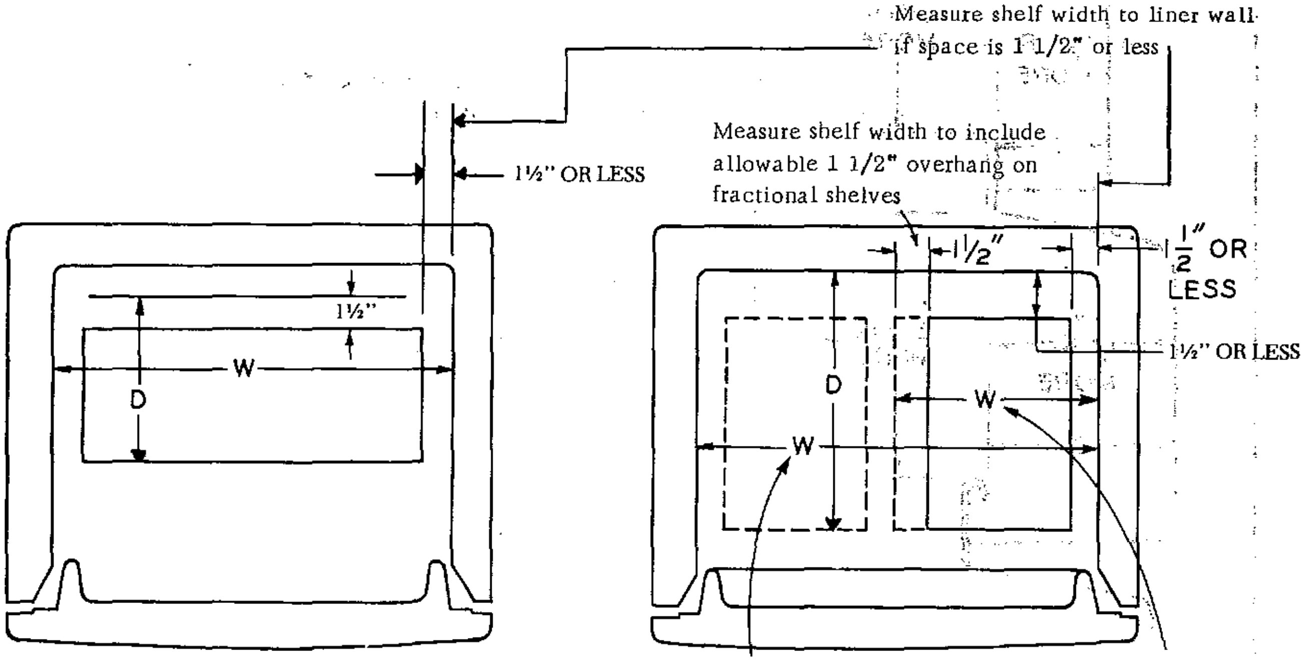
FULL SHELF

Deduct this area generated by the amount that "A" exceeds 3" and "B" exceeds 1½".

Deduct area of all cutouts as noted

Deduct this area generated by "X" and "Y"

CUT-OUT SHELF



Measure shelf width to liner wall if space is 1 1/2" or less

Measure shelf width to include allowable 1 1/2" overhang on fractional shelves

FRACTIONAL SHELF

Fractional shelves which equal a full shelf shall be included as a full shelf width

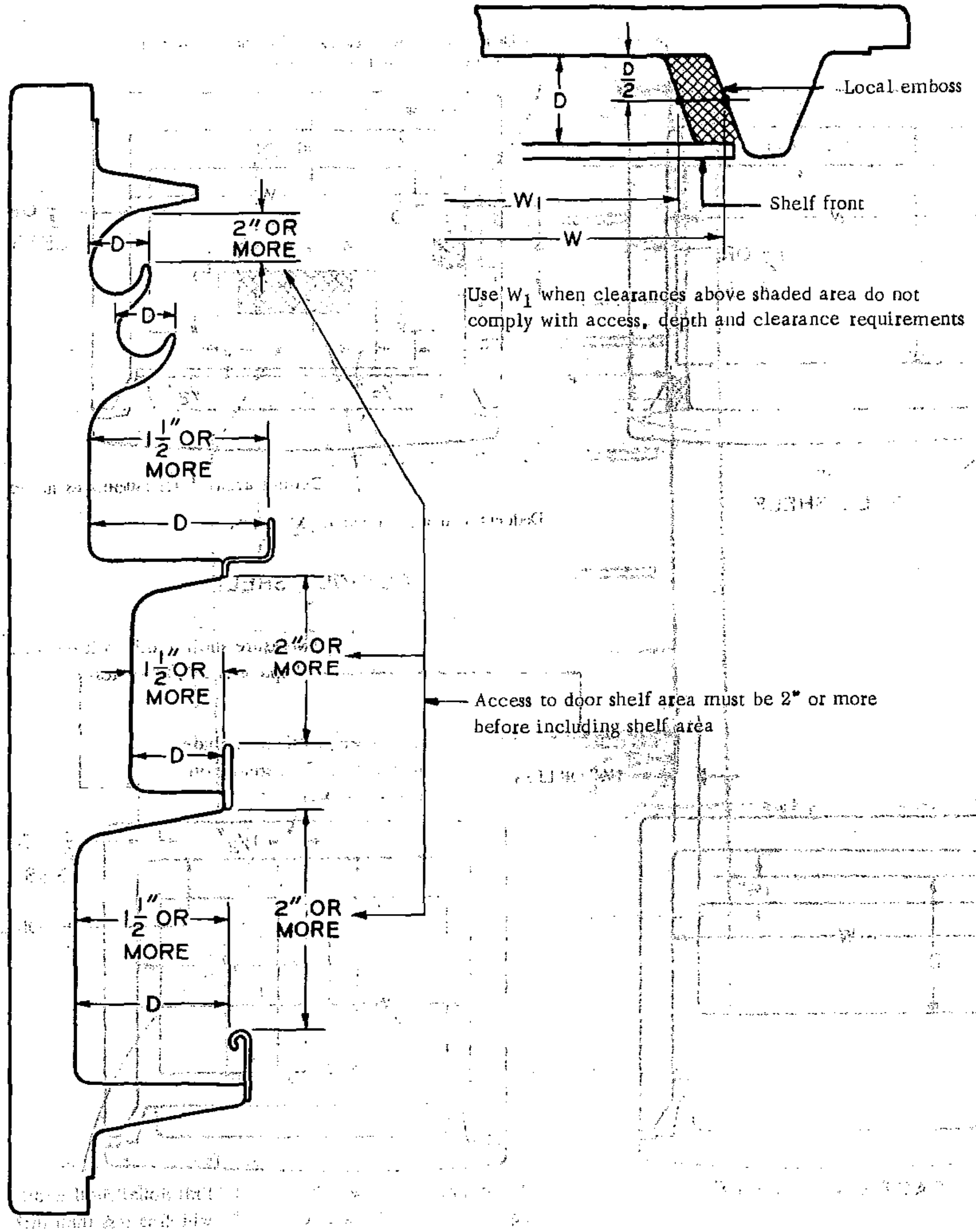
Fractional shelf width which is less than full shelf width

FRACTIONAL SHELVES

Fig. 5-11

Width and Depth Requirements (Total Shelf Area)

For Legend See Par. 5.5



Use W_1 when clearances above shaded area do not comply with access, depth and clearance requirements

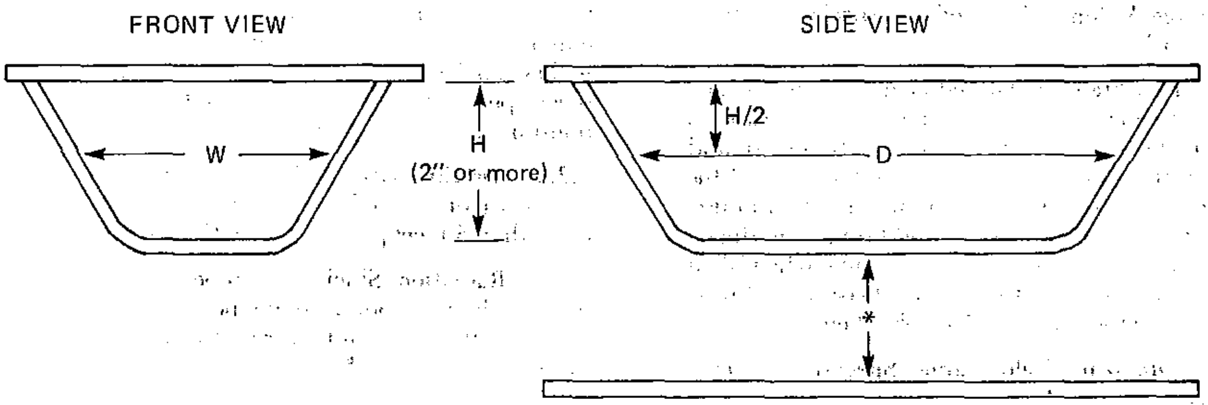
Access to door shelf area must be 2" or more before including shelf area

Fig. 5-12

Doors (Total Shelf Area)

FIGURE 5–13

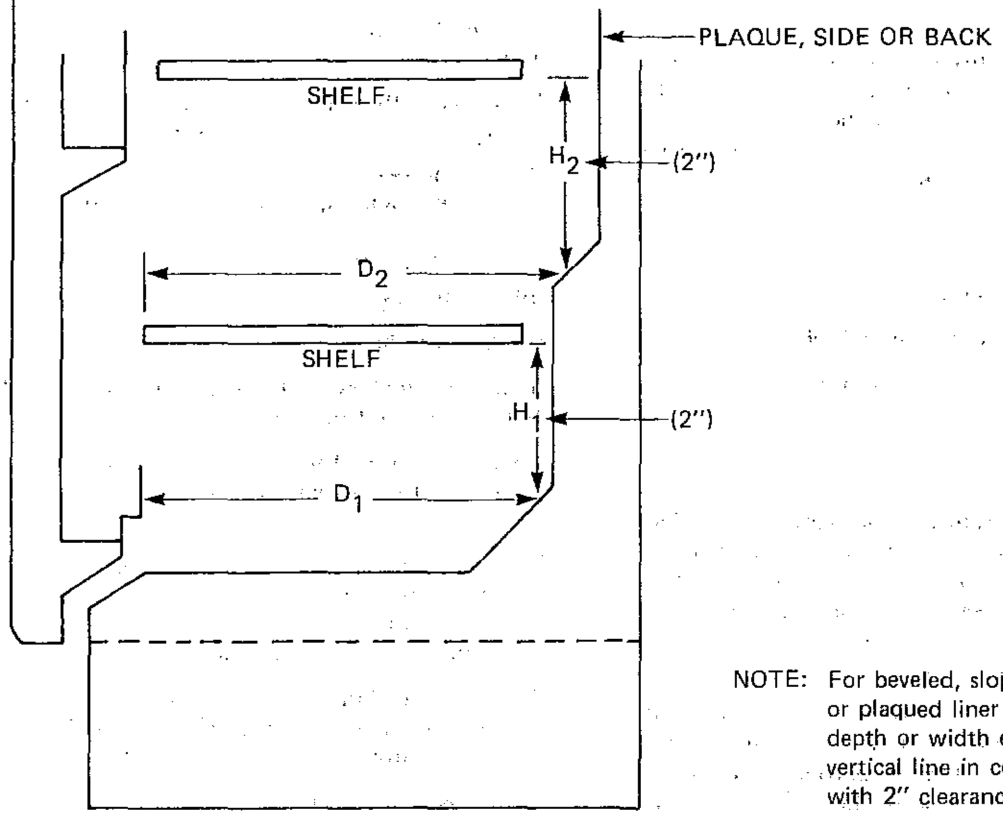
Suspended Containers (Total Shelf Area)



*There must be a minumum of 2" clearance between the bottom of a suspended container and the shelf beneath it to include the shelf area of both.

FIGURE 5–14

Beveled Liner Surfaces (Total Shelf Area)



NOTE: For beveled, sloped bottoms, or plaqued liner walls, use depth or width extended to vertical line in compliance with 2" clearance limitation.

all storage volumes occupied by the special features to the nearest 0.01 cubic foot (nearest .25 liter) separately for freezer compartments and fresh food compartments.

6.2.8 Storage Volume Provided by Special Features. (See Figures 6-1 to 6-3.)

6.2.8.1 Free-Standing Special Features. The storage volume provided by free-standing special features is the product of the average interior width, length and the height from the interior bottom to the cover of the container when installed in its normal position in use. For ice trays, ice storage bins, and liquid containers, the storage volume is the interior volume when filled to the maximum operating level. Measure all linear dimensions to the nearest 1/16 inch (.2 cm).

6.2.8.2 Supported-Relocatable Special Features. (Same as 6.2.8.1.)

6.2.8.3 Supported-Fixed Special Features. (Same as 6.2.8.1.)

6.2.8.4 Data To Be Reported. The sum of the volumes provided by special features is reported to the nearest 0.01 cubic foot (nearest .25 liter) separately for freezer compartments and fresh food compartments.

7. PERFORMANCE TEST PROCEDURES AND RECOMMENDED LEVELS OF PERFORMANCE FOR HOUSEHOLD REFRIGERATORS AND HOUSEHOLD FREEZERS

7.1 Scope of Section 7. This section describes uniform procedures for determining the performance of mechanically-operated household refrigerators and household freezers under specified laboratory test conditions and establishes recommended levels of performance.

7.1.1 The performance test procedures in this section are:

7.5 No-load pull-down test.

7.6 Simulated load test (household refrigerators).

7.7 Simulated load test (household freezers).

7.8 Ice-making test.

7.2 Test Room.

7.2.1 Ambient Temperature. The vertical ambient temperature gradient in any foot of vertical distance from 2 inches (5.1 cm) above the floor or supporting platform to a height of 7 feet (2.17 m) or to a height 1 foot (30.5 cm) above the top of the cabinet, whichever is greater, is not to exceed 0.5°F per foot (0.9°C per meter).

If a platform is used it is to have a solid top with all sides open for air circulation underneath, and its top shall extend at least 1 foot (30.5 cm) beyond each side and front of the cabinet and extend to the wall in the rear. This platform must be used if the floor temperature is not within 3°F (1.7°C) of the specified ambient temperature (see Paragraph 7.5.3.1).

7.2.2 Ambient Relative Humidity. Wet bulb and dry bulb readings are to be taken at a location 3 feet (91.5 cm) above the floor or platform and approximately 10 inches (25.4 cm) from the front of the cabinet. Except when specified for particular tests, the ambient relative humidity need not be controlled.

7.2.3 Air Circulation. The cabinet under test is to be shielded from forced air currents having a velocity of more than 50 feet per minute (0.254 meters per second).

7.2.4 Radiation. Shields are to be provided to prevent direct radiation from or to any heated or cooled surfaces whose temperature differs from the air temperature by more than 10°F (5.6°C).

7.3 Instruments.

7.3.1 Temperature. The temperature measurements are to be made with one or more of the following instruments or their equivalents.

(a) Glass thermometers (ambient measurements only).

(b) Thermocouples.

(c) Electric resistance thermometers and thermistors.

If a mass is used to increase the heat capacity of a temperature sensor, the total heat capacity of the mass is not to exceed that of 20 grams of water.

Temperature readings are to be accurate within 1°F (0.5°C).

In no case is the smallest scale division of the measuring instrument to exceed two times the specified accuracy.

7.3.2 Electrical. Electrical measurements are to be made with the following instruments or their equivalents.

(a) Watt hour meters.

(b) Voltmeters.

(c) Microammeters.

Watt hour meters are to be graduated to 0.01 kilowatt-hour without estimating fractions of a division.

Instruments used for measuring the electrical input are to be accurate to within ±0.5 percent of the quantity measured.

The microammeter used for measuring current leakage is to be accurate to within ±0.5 percent at an indication of 0.5 milliamperes, the meter terminal impedance — 1500 ohms shunted by a .15 mfd capacitance.

7.3.4 Time. Time measurements are to be made with a synchronous self-starting electric clock or a similar time-integrator.

7.3.5 Relative Humidity. The relative humidity is to

FIGURE 6–1

Volumes Occupied by and Provided by Typical Free-standing and Supported-Relocatable Special Features

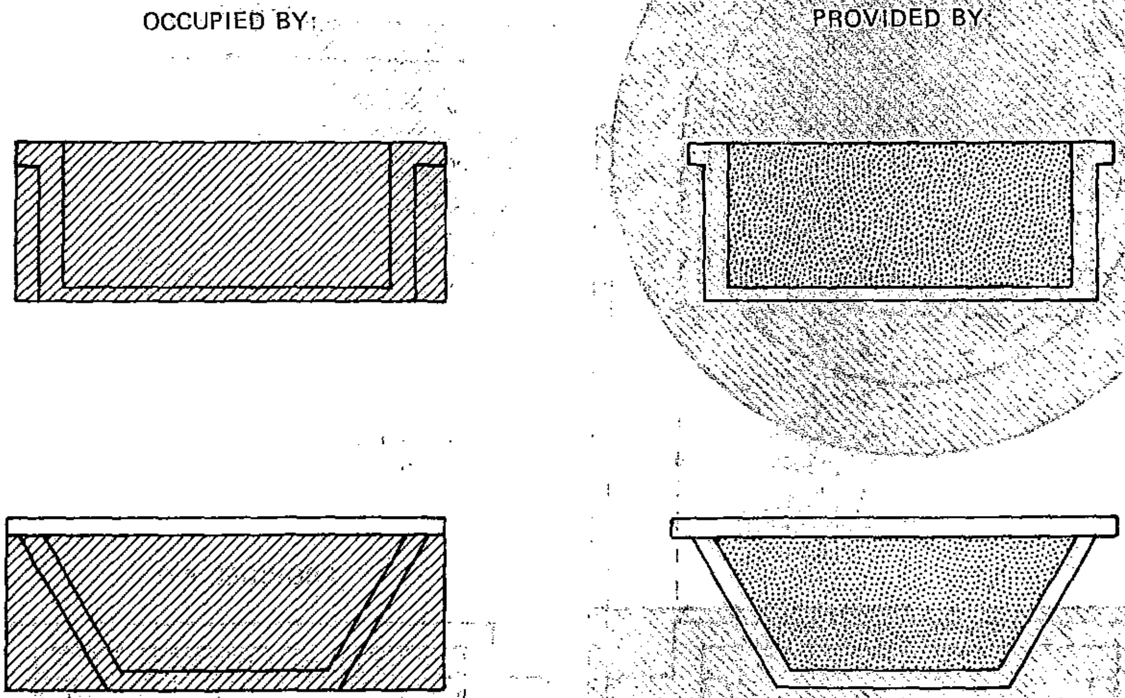
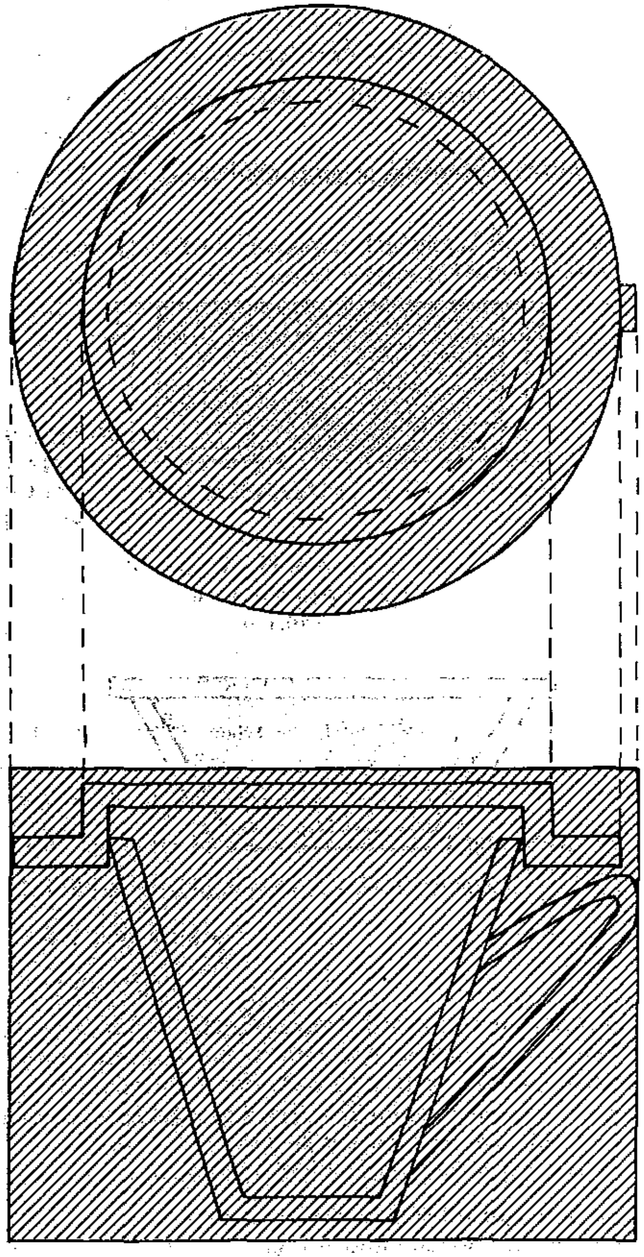


FIGURE 6–1 (Continued)

Volumes Occupied by and Provided by Typical Free-standing and Supported-Relocatable Special Features

OCCUPIED BY:



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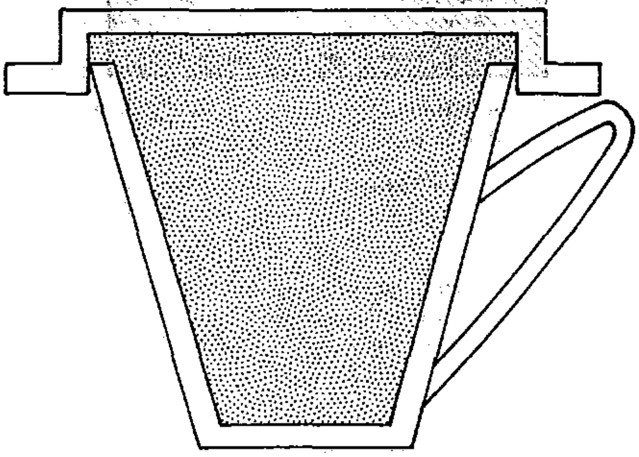

FIGURE 6–1 (Continued)

Volumes Occupied and Provided by Typical Free-Standing
and Supported-Pelocatable Special Features

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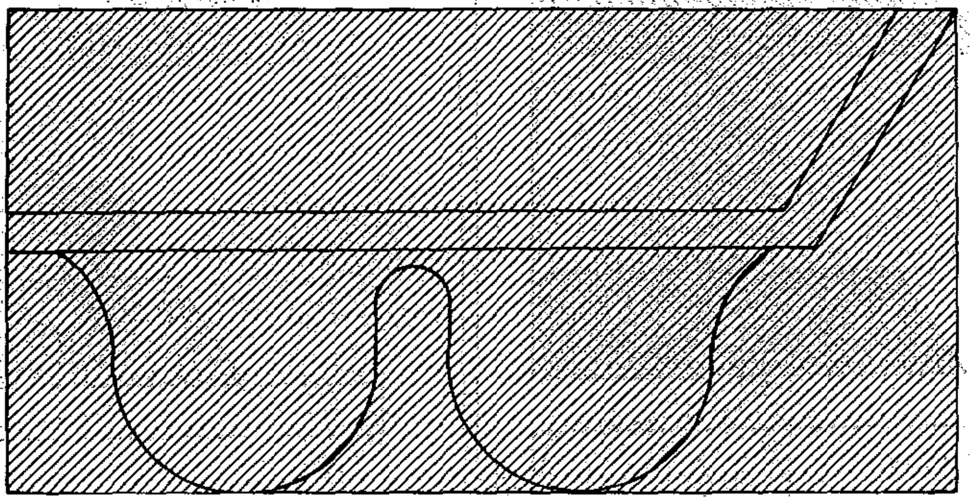

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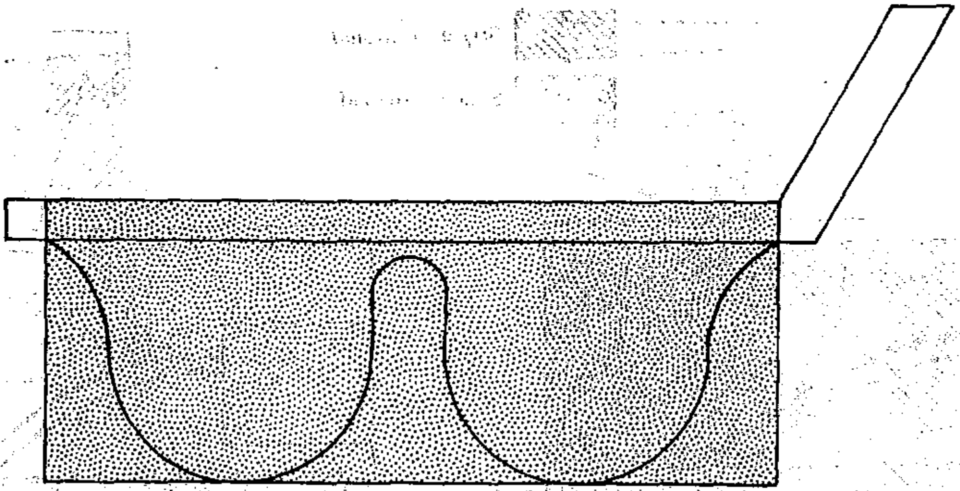

EGG TRAYS

FIGURE 6–2

Volumes Occupied By and Provided By Typical Supported-Fixed Special Features

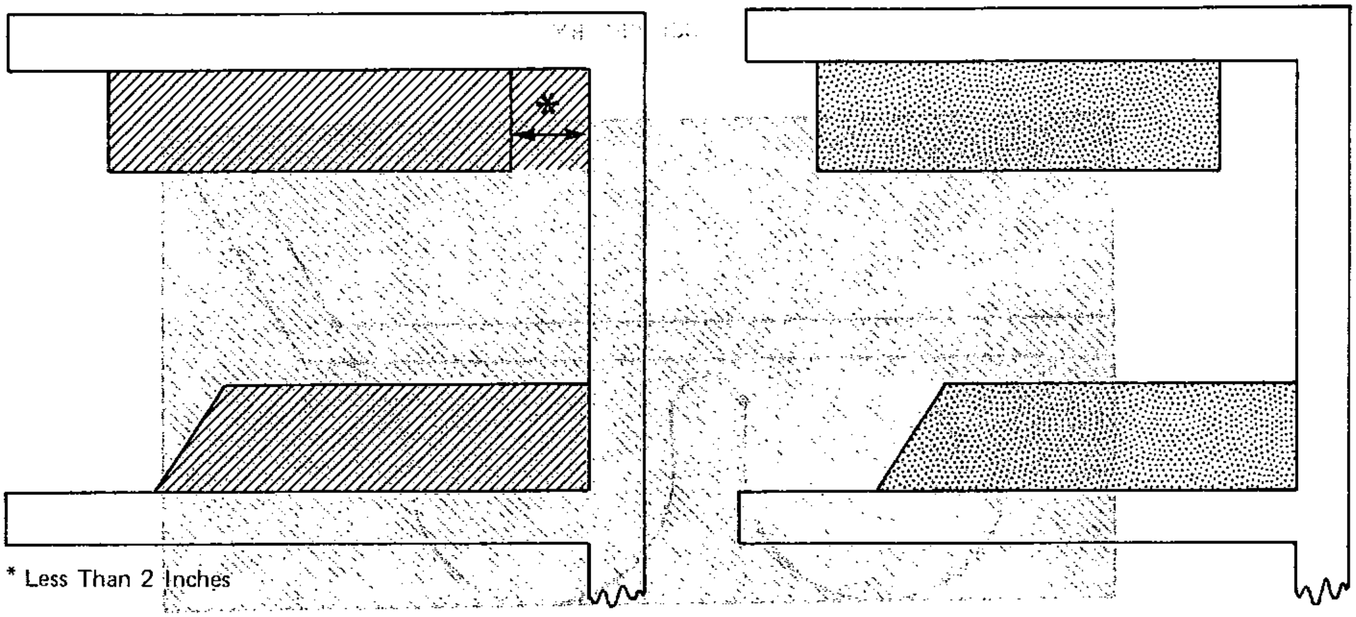

Illustration of ice tray storage compartments.

Volumes to be included are dependent upon the dimensional requirements of Section IV. If the distance in front or behind the storage compartment is 2 inches or more, that volume is not deducted.

▨ Space Occupied

▒ Space Provided

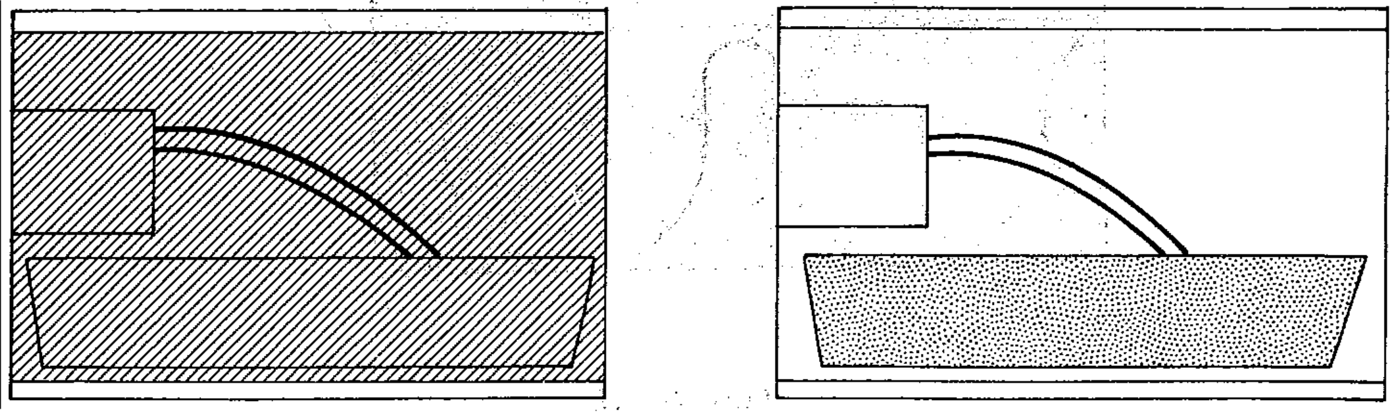

FIGURE 6–2 (Continued)

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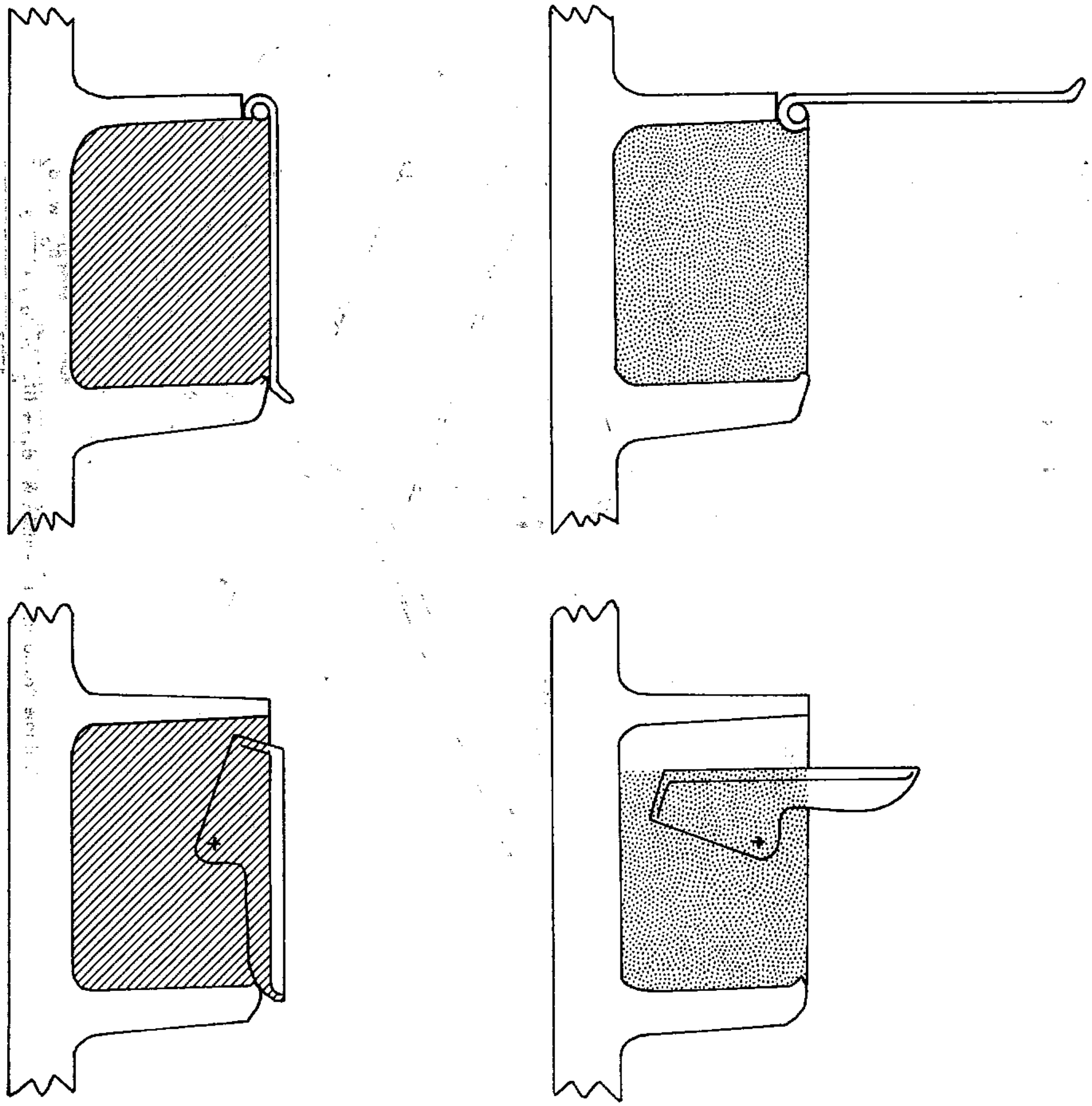
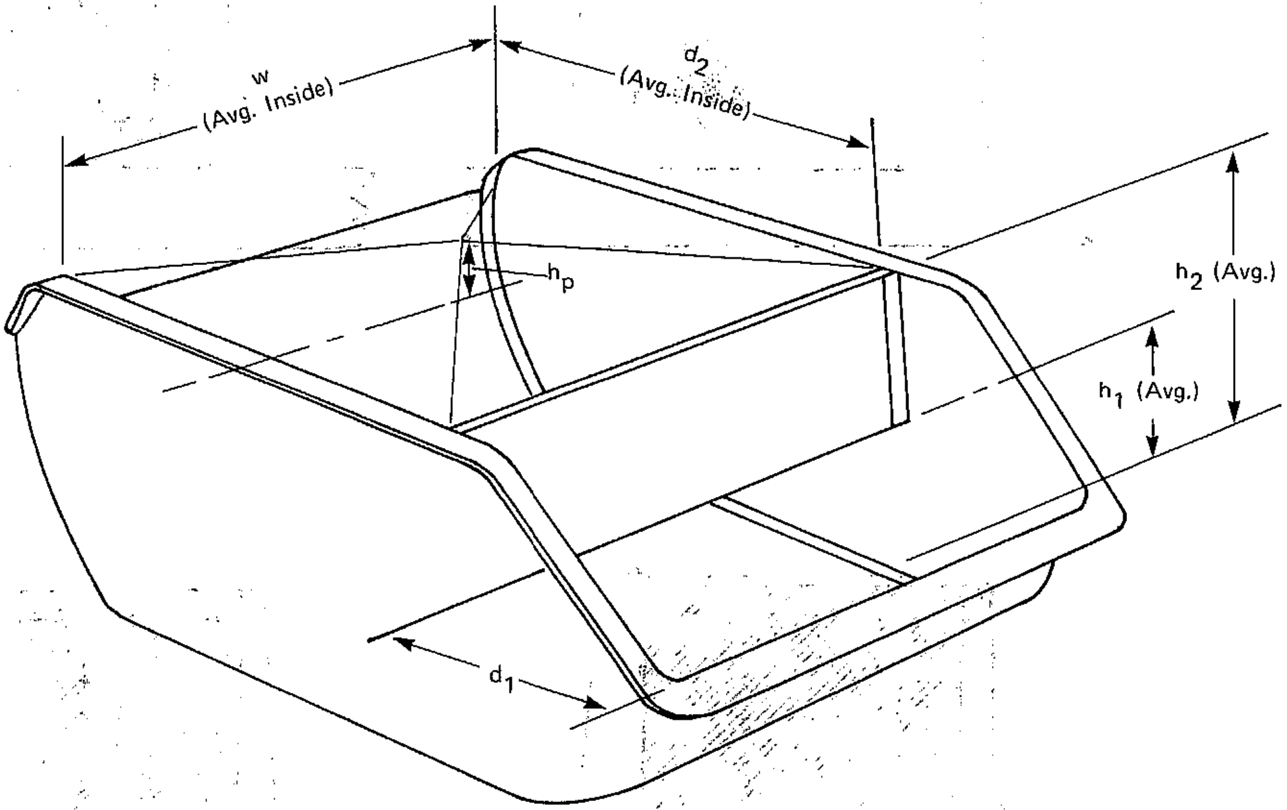


BUTTER OR CHEESE COMPARTMENT

FIGURE 6–3

Volume Provided by Irregular Shaped Ice Buckets
or Free-standing Containers

$$h_p = \frac{\text{either } w \text{ or } d_2 \text{ (whichever is less)}}{4}$$



$$\text{Volume Provided, FT}^3 = \frac{(h_1 \cdot w \cdot d_1) + (h_2 \cdot w \cdot d_2) + \frac{h_p \cdot w \cdot d_2}{3}}{1728}$$

FIGURE 6–3 (Continued)

Volume Provided by Irregular Shaped Ice Buckets or Free-standing Containers

$$h_p = \frac{\text{either w or d}}{4} \text{ (whichever is less)}$$

$$\text{Volume Provided, FT}^3 = \frac{h \cdot w \cdot d + \left(\frac{h_p \cdot w \cdot d}{3}\right)}{1728}$$

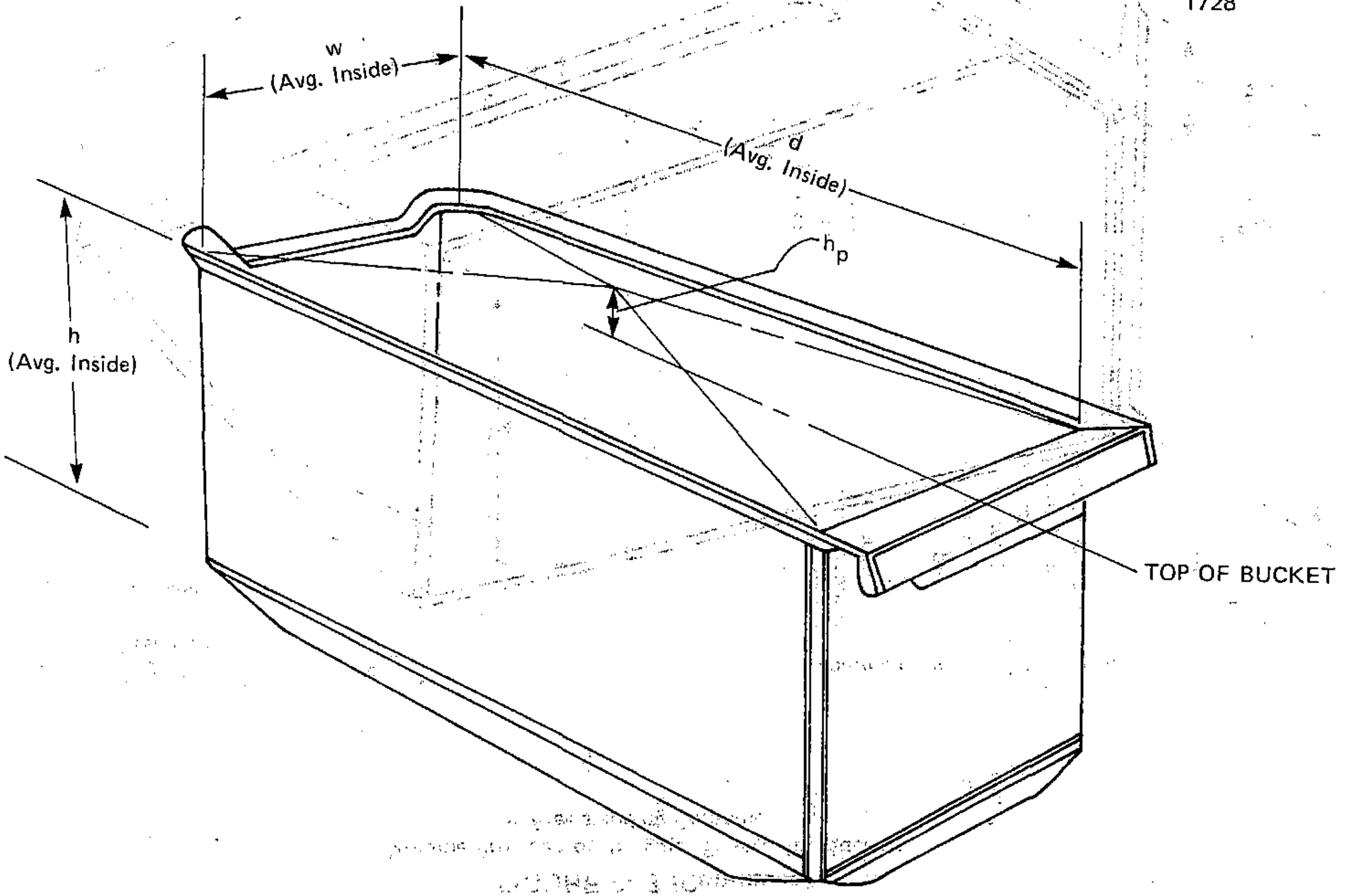
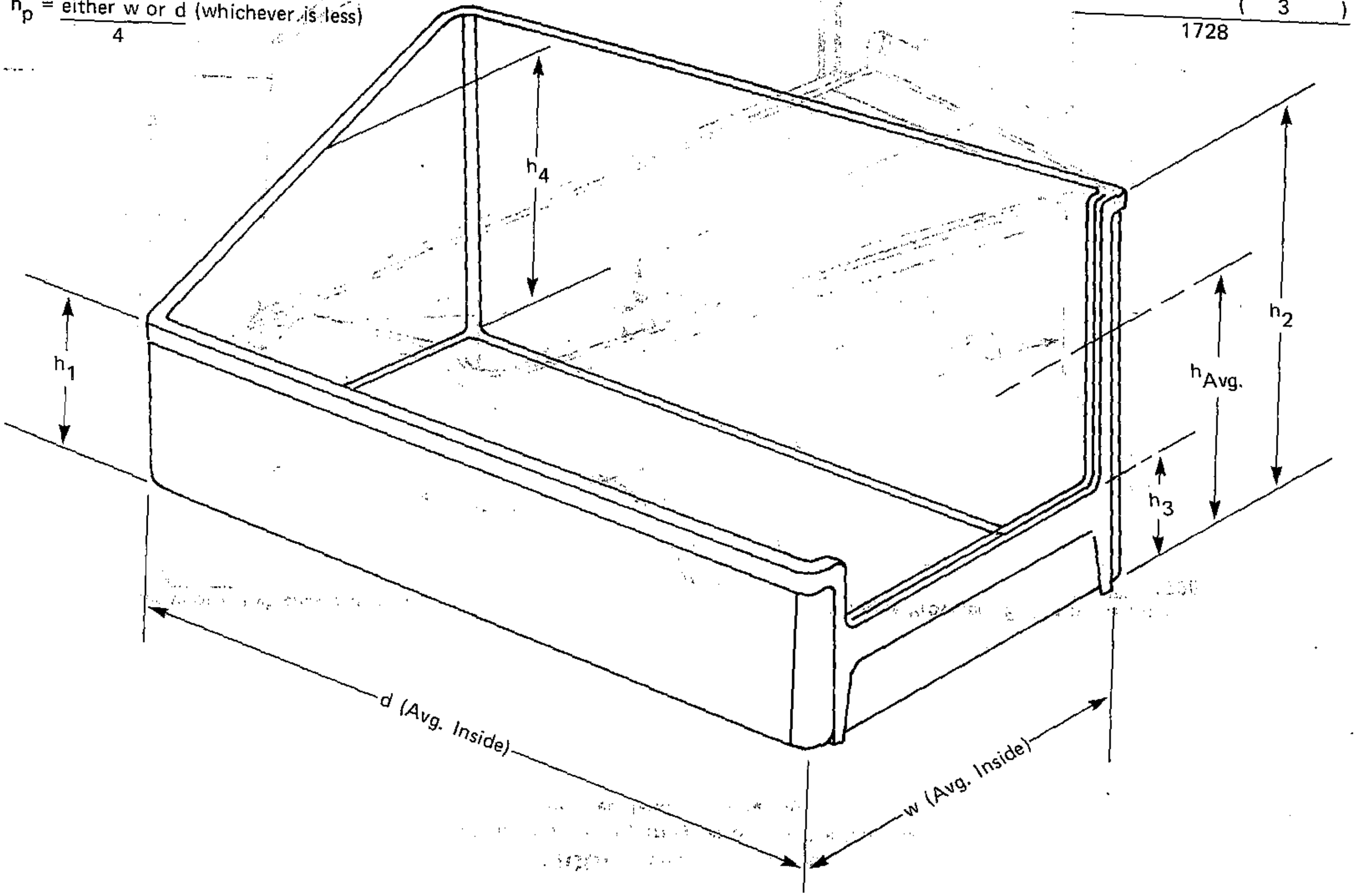


FIGURE 6–3 (Continued)
Volume Provided by Irregular Shaped Ice Buckets
or Free-standing Containers

$$h_{Avg.} = \frac{(h_1 \cdot d) + (h_2 \cdot d) + (h_3 \cdot w) + (h_4 \cdot w)}{2\,(w + d)}$$

$$h_p = \frac{\text{either } w \text{ or } d}{4} \text{ (whichever is less)}$$

$$\text{Volume Provided, } FT^3 = \frac{(h_{Avg} \cdot w \cdot d) + \left(\frac{h_p \cdot w \cdot d}{3}\right)}{1728}$$



be determined by use of a psychrometric chart and wet and dry bulb readings taken with suitable psychrometric instrumentation having an accuracy of ±0.5°F (0.3°C).

7.3.6 **Weight.** Weight is to be determined by use of scales accurate to within 0.01 pound (4.5 g).

7.4 **General Test Requirements.** For each test the cabinet is to be operated at the specified test conditions for a sufficient length of time to establish steady state condition (see Paragraph 3.19) and then for the additional period specified as the test period.

7.4.1 **Power Supply.** The electrical power supply is to be 115V ± 1%, 60 Hz at the product service connection. The actual voltage is to be reported as measured at the product service connection with the compressor motor operating.

7.4.2 **Test Sample.** The cabinet with its refrigerating mechanism is to be assembled and set up as nearly as practicable in accordance with the printed instructions supplied with the cabinet. All packing materials and skid boards are to be removed. Chiller or drip trays are to be in their proper places during all tests. Outer door gaskets are to be checked for adequacy of seal to the cabinet and adjusted, if required. Containers and covers and food shelves are not to be removed. Unless otherwise specified:

Baffles are to be open unless otherwise specified in the manufacturer's instructions;

Automatic ice makers are to be inoperative during the test;

Butter conditioners are set in the lowest energy usage position when adjustment is provided;

Convenience lights, radios, clocks, hygienic lamps, and the like are set at their lowest energy usage positions when adjustment is provided;

The anti-sweat heater switch is set at its highest energy consuming position;

Features which are electrically powered, manually initiated, and automatically terminated (such as customer operated dispensers, fast chill compartments, electric door openers, etc.) are operated at their lowest energy usage position;

Compartments which are convertible from refrigerator to freezer are operated in the highest energy usage position;

Other temperature controllable compartments (such as crispers convertible to meat keepers and temperature adjustable meat keepers) are considered special compartments and are tested with controls set to provide the coldest temperature;

Evaporator in manual defrost models need not be defrosted prior to each test unless frost accumulation exceeds ¼ inch (0.6 cm) in average thickness. Chiller and drip trays and interior of cabinet are to be dried prior to start of test after evaporator has been manually defrosted;

Ice trays and ice buckets related to non-automatic ice making are removed from the freezer section and the space vacated is loaded to 75% of its capacity with frozen food packages. Ice storage bins of automatic ice makers are to be full of frozen food packages;

Storage baskets in chest freezers are removed if they are removable without the use of tools;

Defrost controls are not to be operative during the tests.

Before the cabinet is tested, it shall be given a "run-in" period sufficient to assure a thorough working-in of mechanical parts, including operating controls. A "run-in" period of one week is recommended and, in no case, shall it be less than 24 hours of compressor run time. The "run-in" may be made at any convenient room temperature.

Unless otherwise specified, the cabinet shall be installed with all of its sides, except the back, more than 10 inches (25.4 cm) from walls or ceiling to insure free air circulation. The space between the back and the wall shall be in accordance with the manufacturer's instructions or as determined by mechanical stops on the back of the cabinet.

Unless otherwise specified, cabinet doors shall be kept closed during all tests.

All leads from all measuring devices shall be brought outside of the cabinet in such a manner as to prevent air leakage.

7.4.3 **Temperature Measurement.**

7.4.3.1 **Ambient Temperature.** The ambient temperature is to be recorded at points located 3 feet (91.5 cm) above the floor line and 10 inches (25.4 cm) from the center of the two sides of the cabinet. The temperature at each point is to be maintained within ± 1°F (0.6°C) of the specified value and is to be maintained during stabilization periods as well as during actual test runs.

Temperature measuring devices are to be located or shielded so that indicated temperature will not be affected by the operation of the condensing unit.

Ambient air temperature is to be recorded at each of the specified positions at intervals not greater than 30 minutes during the test periods.

7.4.3.2 **Fresh Food Compartment Temperature (Household Refrigerators).** Temperatures are to be recorded at three locations as shown in Figure 7-1. All temperature measuring devices are to be supported in such a manner that there will be at least 1 inch (2.54 cm) of air space separating the thermal mass from contact with any surface. In case of interference with hardware at these locations, the temperature measurements are to be taken at the nearest adjacent location such that there will be 1 inch (2.54 cm) air space separating the thermal mass from the hardware.

If the interior arrangements of the cabinet do not conform with those shown in Figure 7-1, measurements are to be taken at selected locations chosen to approximately represent the entire fresh food compartment. The locations selected are to be reported.

The reported temperature at any given point is to be the average temperature at that point during a cycle of operation with the temperatures being read at regular intervals not exceeding 4 minutes.

For no-load pull-down and simulated load tests where one or more special compartments are provided for temperatures and humidities higher or lower than that of the fresh food compartment, a temperature measuring device is to be located at the geometric center of each compartment and the average temperatures reported as determined above.

The reported temperature of the fresh food compartment is to be the average of the temperatures recorded at the three locations shown in Figure 7-1.

7.4.3.3 Freezer Compartment Temperature (Household Refrigerators and Household Freezers). Freezer compartment temperatures are to be measured at the geometric center of the filled packages described below, with the packages located so the temperature measurement stations approximate the locations shown in Figure 7-2.

Temperatures are to be measured by unweighted thermocouples, located in the geometric center of packages, measuring approximately 5 × 4 × 1½ inches (approximately 13 × 10 × 4 cm).

The packages are to be sealed and are to contain a liner or wrapper that makes them moisture and vapor-proof.

The packages are to be filled to a density of 35 ± 5 pounds per cubic foot with hardwood sawdust which has been water-soaked or alternately is to be an equivalent package of frozen food such as chopped spinach.

The freezer compartment is to be loaded with 75% of the maximum number of filled packages that can be fitted into the compartment. The 75% load is to be fitted into the compartment(s) so as to permit air circulation around and above the load.

The air gap around the freezer compartment load is to be ½ to 1½ inches (1.5 to 4 cm) with the packages in a pyramid or tiered form if necessary to properly locate the thermocouples.

NOTE: In order to keep packages from shifting and destroying the air gap, a wire grid with small, non-thermally conductive spacers for contact with freezer liner may be used.

Each shelf of freezers and freezer sections of combination refrigerator-freezers, where applicable, is to be loaded to 75% of its capacity in pyramid or tiered form, as necessary, for the proper location of the thermocoupled frozen food package.

Freezer door shelves are to be loaded with the maximum number of filled packages that can be fitted in each shelf. A thermocouple is to be placed at the geometric center of a package located at the vertical centerline of each shelf so that it will be approximately 2 inches (5.1 cm) from the surface of the inner door liner and 2½ inches (6.4 cm) from the shelf surface as indicated in Figure 7-3.

If the interior arrangements of the freezer compartment shelves do not conform with those shown in Figure 7-2, measurements are to be taken at locations selected to represent the intent of the standard. The locations selected are to be reported. The reported temperature at any given point is to be the average temperature at that point during a cycle of operation with the temperature being read at regular intervals not exceeding 4 minutes.

The reported temperature of the freezer compartment is to be the average of the temperatures recorded at the locations shown in Figure 7-2.

7.5 No-Load Pull-Down Test (Household Refrigerators and Household Freezers).

7.5.1 Purpose. The purposes of this test are to establish that the cabinet temperature will be reduced from ambient to food storage temperature, to determine the rate at which this change takes place and to observe the lowest steady state temperatures attained in the storage compartments.

7.5.2 Test Conditions. The general test conditions are to be in accordance with Paragraphs 7.2, 7.3, and 7.4 except as stated below.

The ambient temperature is to be 110°F (43.3°C).

The cabinet is to be prepared with its shelves and accessories in place in accordance with the manufacturer's instructions, but without a freezer compartment simulated food and ice load.

Freezer compartment temperatures are to be recorded at the locations shown in Figure 7-2. All temperature measuring devices are to be supported in such a manner that there will be at least ½ inch (1.5 cm) of air space separating the thermal mass from contact with any surface. In case of interference with hardware at these locations, the temperature measurements are to be taken at the nearest adjacent location such that there will be ½ inch (1.5 cm) air space separating the thermal mass from the hardware.

The cabinet, with all compartment doors open, is to have been electrically disconnected for at least 8 hours in an ambient temperature of 110°F (43.3°C) immediately preceding the start of the test.

During the test, all refrigeration system controls (thermostats, automatic defrost controls, etc.) are to be electrically disconnected or inactivated to insure continuous operation of the refrigerant motor compressor, but the motor overload protector, if provided, is not to be disconnected or inactivated.

7.5.3 Test Procedure. The cabinet door(s) is to be closed and the cabinet operated continuously until steady state condition has been reached or until it is evident that the unit will continue to cycle on the overload protector.

7.5.4 Data To Be Reported.

(a) Type, model number, serial number, if any, and manufacturer or brand name of cabinet.

(b) Ambient temperature.

(c) Voltage and frequency.

(d) Time for fresh food compartment temperature of household refrigerator to reach 41°F (5°C). When this temperature cannot be attained, the time to reach steady state condition when the unit is running continuously, or steady state condition when the unit is cycling on the overload protector, is to be reported. The steady state temperatures obtained are also to be reported.

(e) Time for freezer compartment temperature to reach 32°F (0°C) for basic refrigerators and 5°F (−15°C) for combination refrigerator-freezers and freezers. When these temperatures cannot be attained, the time to reach steady state condition when the unit is running continuously, or steady state condition when the unit is cycling on the overload protector, is to be reported. The steady state temperatures obtained are also to be reported.

(f) Steady state condition temperature(s).

7.6 Simulated Load Test (Household Refrigerators).

7.6.1 Purpose. The purpose of this test is to determine thermal performance under varying ambient conditions (temperature averages, maximum differentials, etc.) and the comparative electrical energy consumed at these varying ambients.

7.6.2 Test Conditions. The general test conditions are to be in accordance with Paragraphs 7.2, 7.3, and 7.4.

The data to be reported is to be obtained at the ambient and average fresh food compartment temperatures specified in Table I for basic refrigerators and all-refrigerators.

TABLE I

Ambient Temperature Degrees	Fresh Food Compartment Temperature Degrees
70°F (21.1°C)	36°F (2.2°C)
90°F (32.2°C)	38°F (3.8°C)
110°F (43.3°C)	41°F (5.0°C)

Household refrigerators with fixed temperature controls are tested at the fixed control position.

For combination refrigerator-freezers with separate controls for the fresh food compartment and the freezer compartment, the data to be reported is to be obtained with an average freezer compartment temperature of 5°F (−15°C) and the fresh food compartment temperatures and ambient temperatures specified in Table I.

For combination refrigerator-freezers with single controls, the data to be reported is to be obtained at the ambient temperatures specified in Table I with an average freezer compartment temperature of 5°F (−15°C) and whatever average fresh food compartment temperatures exist with these control settings.

7.6.3 Test Procedure. For convenience, either of the following two procedures may be used for either single or multiple control cabinets.

7.6.3.1 Interpolation Procedure. The cabinet is to be operated at each of the three (3) ambient temperatures (see Table I) and at least each of the following control positions.

Control Positions

	Multiple Control	
Single Control	Primary Control	Secondary Control
Warmest	Warmest	Warmest
	Warmest	Coldest
Coldest	Coldest	Coldest
	Coldest	Warmest
Intermediate	Warmest	Intermediate
	Coldest	Intermediate

NOTE: The primary control is that device which initiates compressor operation.

At one or more of the intermediate control(s) positions the tests in the ambient temperature of 70°F (21.1°C) and 90°F (32.2°C) are to be run without resetting the control(s).

Fixed control refrigerators are tested at the fixed control position.

After steady state condition has been reached, each test period is to be at least two whole cycles, i.e., an equal number of off and on periods of the compressor motor, if cycling occurs, and not less than three hours.

From the data obtained at each of the settings of the temperature control(s), curves are to be plotted (show actual data points when plotting) for the average fresh food compartment temperature versus:

(a) Average freezer compartment temperature,

(b) Average temperature of each special compartment, if applicable,

(c) Warmest freezer door shelf frozen food package temperature, if applicable,

(d) Energy (kWh) consumed during a 24-hour period,

(e) Percent operating time of the compressor motor and,

(f) The number of cycles for a 24-hour period.

The reported average compartment temperature is to be the average of the temperature readings taken during a complete cycle of the temperature controller for that compartment. The data for the specified compartment(s) temperatures for each of the three ambient temperatures is to be obtained from these curves (see Figures 7-4 and 7-5 for examples).

If the curve does not reach the specified compartment temperature(s), the data for the point at the extreme end of the curve closest to the specified temperature(s) is to be used. This condition shall be clearly described in reporting on the cabinet under test.

7.6.3.2 Specific Control(s) Setting Procedure. The cabinet is to be operated at each of the three ambient temperatures and at control positions as required to obtain the compartment(s) temperatures stated in Table I within the tolerances stated in Table II.

TABLE II

Tolerances on Controlled Temperatures

	Fresh Food Compartment	Freezer Compartment
Basic Refrigerator and All-Refrigerator	± 1°F (0.6°C)	—
Combination Refrigerator-Freezer, Single Control	—	± 5°F (0.3°C)
Combination Refrigerator-Freezer, Multiple Control	± 1°F (0.6°C)	± 5°F (0.3°C)

After steady state condition has been reached, each test period is to be at least two whole cycles, i.e., an equal number of off and on periods of the compressor motor if cycling occurs, and not less than 3 hours. In the event that the 5°F (−15°C) freezer compartment temperature or the specified fresh food compartment temperature cannot be achieved in any of the standard test ambients, then the test is to be conducted and the data reported at compartment temperatures as close to the specified values as may be achieved.

In addition, a test to demonstrate control response is to follow the simulated load test run at either 70°F (21.1°C) or 90°F (32.2°C) ambient temperature, and is to consist of a repeat of that test in the other of the two ambient temperatures 70°F (21.1°C) or 90°F (32.2°C) without changing any control setting(s). The data to be reported is to include results for at least four tests, a simulated load test at 70°F (21.1°C), 90°F (32.2°C) and 110°F (43.3°C) ambient temperature, and the control response test made following either the 70°F (21.1°C) or 90°F (32.2°C) ambient temperature simulated load test.

7.6.4 Data To Be Reported.

(a) Type, model number, serial number, if any, and manufacturer or brand name of cabinet.

(b) Ambient temperature.

(c) Voltage and frequency.

(d) Plot observed data; see Figures 7-4 and 7-5 for examples. Not required for Specific Control(s) Setting procedure (see Paragraph 7.6.3.2).

(e) Average fresh food compartment temperature.

(f) Average freezer compartment temperature.

(g) Average special compartment(s) temperature(s).

(h) Warmest freezer door-shelf frozen-food package temperature.

(i) For each control(s) position in the 70°F (21.1°C) and 90°F (32.2°C) ambients, tabulate the maximum and minimum temperature values observed for the warmest and coldest fresh food compartment temperature recording locations (see sample Table, Figures 7-7 and 7-7A).

(j) Energy (kWh) consumed during a 24-hour period.

(k) Percent operating time of the compressor motor.

(l) Number of cycles during a 24-hour period.

7.6.5 Recommended Levels of Performance.

7.6.5.1 It is recommended that in the fresh food compartment of household refrigerators, an average temperature within the range of 34°F and 41°F (1.1°C and 5°C) be attainable between the warmest and coldest setting(s) of the control(s) when tested in ambients of 70°F (21.1°C), 90°F (32.2°C) and 110°F (43.3°C). The control setting(s) may be adjusted for each ambient.

The period of time that most fresh food used in today's household can be safely stored is dependent upon temperature — the lower the temperature the longer most foods can be safely stored.

34°F (1.1°C) is as close to freezing as is practical in order that no section of the fresh food compartment permits freezing.

41°F (5°C) is not quite so limiting. It is chosen as a guide based on experience. Higher temperatures will shorten safe storage periods. Refrigerator-freezer design and development engineers believe 41°F (5°C) to be a very practical but not absolute upper limit.

7.6.5.2 It is recommended that in the freezer compartment the average temperature be less than or equal to 15°F (−9.4°C) for basic refrigerators and less than or equal to 5°F (−15°C) for combination refrigerator-freezers when tested in 90°F (32.2°C) ambient.

Although it is not necessary for the recommended freezer and fresh food compartment temperatures (Paragraph 7.6.5.1) to occur simultaneously, it is recommended that the freezer compartment temperatures be attainable with average fresh food compartment temperatures higher than 34°F (1.1°C).

By definition a basic refrigerator is intended for the short term storage of frozen foods; most frozen foods will not freeze or remain frozen above 15°F (−9.4°C) for any reasonable time, based on the sugar content, water content, etc., of the frozen food stored.

5°F (−15°C) for the freezer compartment of a combination refrigerator-freezer is an extension of the definition of a refrigerator-freezer, which limits freezer compartment temperatures to 8°F (−13.3°C). While 8°F (−13.3°C) provides definition, 5°F (−15°C) is the suggested temperature based on the long term economical storage of most frozen foods. The lower the temperature, the longer frozen foods can be safely stored [0°F (−17.8°C) would provide longer safe storage].

7.7 Simulated Load Test (Household Freezers).

7.7.1 Purpose. The purpose of this test is to determine thermal performance under a varying range of control settings and the comparative electrical energy consumed at these settings.

7.7.2 Test Conditions. The general test conditions are to be in accordance with Paragraphs 7.2, 7.3, and 7.4.

The data to be reported is to be obtained at the following ambient and average freezer compartment temperatures:

Ambient Temperature	Average Freezer Compartment Temperature
90°F (32.2°C)	0°F (−17.8°C)

If the door shelves are adjustable, locate the top shelf at the highest provided position that will accommodate a filled package (see Figure 7-3), and locate the bottom shelf at the lowest provided position. The packages containing thermocouples are to be located in accordance with Figures 7-2 and 7-3.

7.7.3 Test Procedure. The cabinet is to be operated at an ambient temperature of 90°F (32.2°C) at each of the three following control positions:

(a) The warmest position (not defrosting).

(b) The coldest position (control not short circuited).

(c) An intermediate position(s).

Household freezers with a fixed temperature control are tested at the fixed control position.

After steady state condition has been reached, each test period is to be at least 2 whole cycles, i.e., an equal number of off and on periods of the compressor motor, if cycling occurs, and not less than 3 hours to obtain the correct percentage of operating time and energy (kWh) consumption rate for a 24-hour period.

From the data obtained at each of the settings of the temperature control, curves are to be plotted (show actual data points when plotting) for cabinet frozen food temperature (see Figure 7-6), versus:

(a) Warmest cabinet food package temperature,

(b) Average door shelf frozen food package temperature (if applicable),

(c) Warmest door shelf frozen food package temperature (if applicable),

(d) Energy (kWh) consumed during a 24-hour period,

(e) Percent operating time of compressor motor,

(f) The number of cycles for a 24-hour period (if applicable) (see Figure 7-6).

If the cabinet does not reach the specified freezer compartment temperature, the data for the point at the extreme end of the curve closest to the specified temperatures is to be reported. This condition is to be clearly described in reporting on the cabinet under test.

7.7.4 Data To Be Reported.

(a) Type, model number, serial number, if any, and manufacturer or brand name of cabinet.

(b) Ambient temperature.

(c) Voltage and frequency.

(d) Plot of observed data (Figure 7-6).

(e) Average freezer compartment temperature.

(f) Warmest cabinet frozen food package temperature.

(g) Average door-shelf frozen food package temperature.

(h) Warmest door-shelf frozen food package temperature.

(i) For each control position, tabulate the maximum and minimum temperature values observed for the warmest and coldest freezer compartment frozen food package. Use freezer compartment portion of table format shown in Figure 7-7.

(j) Energy (kWh) consumed during a 24-hour period.

(k) Percent operating time of compressor motor.

(l) Number of cycles during a 24-hour period.

7.7.5 Recommended Level of Performance. It is recommended that a 0°F (−17.8°C) average freezer compartment temperature be attainable through control adjustment in a 90°F (32.2°C) ambient temperature.

By definition a freezer is designed for the extended storage of frozen food. The 0°F (−17.8°C) average freezer temperature clearly extends safe storage time beyond that of the freezer compartment of a household refrigerator.

0°F (−17.8°C) has long been recognized as the datum for long term safe storage of all frozen foods and has proven over the years to serve the consumers' needs and expectations.

7.8 Ice-Making Test (Household Refrigerators and Household Freezers) if there is provision for making ice.

7.8.1 Purpose. The purpose of this test is to determine the rate of making ice, using ice trays or other ice-making equipment furnished with the cabinet.

7.8.2 Test Conditions. The general test conditions are to be in accordance with Paragraphs 7.2, 7.3, and 7.4.

Ice trays and ice buckets related to non-automatic ice making are to be installed in accordance with manufacturer's instructions removing frozen food packages as required.

Do not put frozen food packages in ice storage bins of automatic ice makers.

The ambient temperature is to be 90°F (32.2°C).

The test period is to begin after the cabinet has reached steady state condition with the control(s) and/or baffles set to maintain the following compartment(s) temperatures. The control(s) settings are not to be changed during the test.

Basic Refrigerator and All-Refrigerator, where applicable, average fresh food compartment temperature 35°F ± 2 (1.7°C ± 1.1).

Combination Refrigerator-Freezer — Single Control, average fresh food compartment temperature 35°F ± 2 (1.7°C ± 1.1).

Combination Refrigerator-Freezer — Multiple Control, average fresh food compartment temperature 38°F ± 2 (3.3°C ± 1.1); freezer control set to coldest position possible without shorting the control and maintaining specified fresh food compartment temperatures.

Household Freezer, freezer control set to coldest position (control not short circuited).

Household Refrigerators and Household Freezers with fixed controls are tested at the fixed control position.

The cabinet door(s) is to be kept closed except when visual inspection of the ice storage bin (for automatic ice makers) is necessary. During such visual inspection the door(s) is to be opened for not more than 15 seconds at a time.

7.8.3 Test Procedure.

7.8.3.1 Ice Tray(s) — including those with automatic fill. The ice tray(s) is to be filled to within 1/8 inch (.3 cm) of the top, or as recommended by the manufacturer, with drinking water having temperature of 90°F ± 2 (32.2°C ± 1.1). Trays which have removable grids are to have the grids in place for this test. Automatic tray fill devices are to be connected, in accordance with manufacturer's recommendations, to a water supply having a temperature of 90°F ± 2 (32.2°C ± 1.1) at the point of connection or entrance to the cabinet. The tray(s) is to be inserted into the cabinet and positioned as recommended by the manufacturer with a minimum door opening time. If the manufacturer recommends that a surface of the cooling unit on which the ice tray(s) rest be wetted to insure good thermal contact, this should be done at the time that the trays are inserted. Each tray is to contain at least one unweighted thermocouple positioned in the location predetermined to be the last in that particular tray to freeze. The thermocouple wires are not to be larger than 0.032 inch (20 AWG).

After the temperature, as indicated by all thermocouples in the ice trays, has reached 28°F (−2.2°C) a visual inspection is to be made to determine that the water is completely frozen. If the water in any tray is not completely frozen, relocate the thermocouples and repeat the test.

Each test is to be continued until the water in all trays is frozen or for a period of 24 hours. If the water in any tray is not completely frozen within 24 hours, the test is to be stopped and the findings recorded in the report.

7.8.3.2 Automatic Ice Maker(s). The automatic ice maker(s) is to be connected in accordance with manufacturer's recommendations, to a water supply having a temperature of 90°F ± 2 (32.2°C ± 1.1) at the point of connection of entrance to the cabinet during the test.

Prior to the initiation of the ice-making test, the automatic ice maker is to have been operating a sufficient time to assure proper operation. There is to be no evidence of free water having entered the storage bin.

For cyclic ice makers the test is to begin at the completion of the water-fill portion of a cycle. For continuous (non-cyclic) ice-making devices, the test may be started at any time after steady state condition has been established. The ice storage bin is to be emptied and repositioned at the time the test is started.

The test is to continue uninterrupted for a minimum of four hours for continuous ice makers and for additional time required to complete a whole number of cycles for cyclic ice makers. The ice storage bin shall not be emptied during the test unless necessary to assure uninterrupted operation. If the ice is removed for this reason, it is to be weighed and this amount added to the weight of the ice in the storage bin at the termination of the test.

At the completion of the test the ice in the storage bin is to be weighed. If there is evidence of free water having entered the storage bin, the test is to be repeated at least once. If this condition continues, the test is to be stopped and the condition reported.

The time duration of the test is to be recorded for use in calculating the ice-making rate for 24 hours.

7.8.4 Data To Be Reported.

7.8.4.1 Ice Tray(s) — including those with automatic fill.

(a) Type, model number, serial number, if any, and manufacturer or brand name of cabinet.

(b) Ambient temperature.

(c) Average fresh food compartment temperature (if applicable) at the beginning of the test.

(d) Average freezer compartment temperature (if applicable) at the beginning of the test.

(e) Voltage and frequency.

(f) The time required for the temperature to reach 28°F (−2.2°C) in each tray.

(g) The material of each tray and grid (plastic, steel, aluminum, etc.).

(h) The weight of ice per tray.

(i) The total weight of ice per freezing.

(j) The position of each tray in the evaporator or freezer compartment.

7.8.4.2 Automatic Ice Maker(s).

(a) Type, model number, serial number, if any, and manufacturer or brand name of the ice maker.

(b) Ambient temperature.

(c) Average fresh food compartment temperatu (if applicable) at the beginning of the test.

(d) Average freezer compartment temperatu (if applicable) at the beginning of the test.

(e) Voltage and frequency.

(f) The ice-making rate in pounds per 24 hours.

7.8.5 Recommended Level of Performance.

7.8.5.1 Ice Tray(s). When tested with the ice tray(s provided by the manufacturer, it is recommende that the total weight of ice per freezing be equivalen to a minimum rate of freezing of 0.4 pounds (.18 kg per hour.

7.8.5.2 Automatic Ice Makers. It is recommende that water be frozen at a minimum rate of 4 pound (1.8 kg) per 24 hours.

These recommended minimum rates of freezing are intended to serve only as a technical guide and an indication of the current state of the art.

8. DURABILITY TEST PROCEDURES AND RECOMMENDED LEVELS OF PERFORMANCE FOR HOUSEHOLD REFRIGERATORS AND HOUSEHOLD FREEZERS

8.1 Scope of Section 8. This section describes uniform procedures for determining the durability of various components of mechanically-operated Household Refrigerators and Household Freezers as affected by use or environmental conditions and establishes recommended levels of performance.

8.1.1 The durability test procedures in this section are:

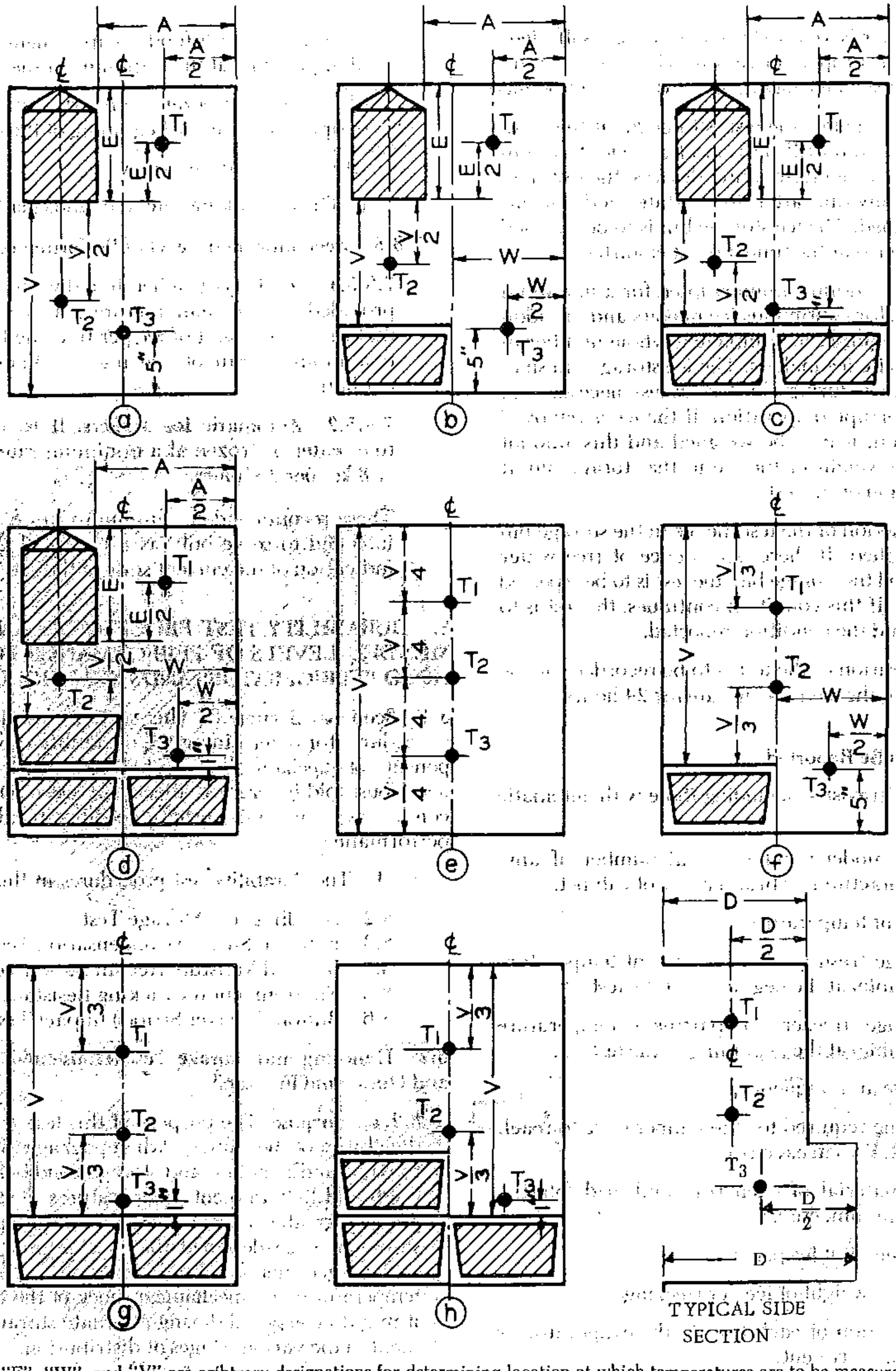
8.2 Handling and Storage Test.
8.3 External Surface Condensation Test.
8.4 Internal Moisture Accumulation Test.
8.5 Environmental Cracking Resistance Test.
8.6 Bottom Breaker Strip(s) Impact Test.

8.2 Handling and Storage Test (Household Refrigerators and Household Freezers).

8.2.1 **Purpose.** The purpose of this test is to determine the ability of the cabinet, when packaged for shipment, to withstand handling and storage conditions in extreme (high and low ambient) temperatures. It is intended to provide greater assurance that a cabinet packaged for shipment is so designed that a consumer will receive undamaged merchandise by exposing it to the extreme temperatures and mechanical shock of the type to which it might be exposed during alternate storage and movement in the various stages of distribution.

8.2.2 **Test Conditions.** The test ambient(s) shall be maintained at temperatures of 140°F ± 5 (60°C ± 2.8) and 0°F ± 5 (−17.8°C ± 2.8).

The floor used for the drop test may be of masonry, metal or other construction with low cushioning effect.



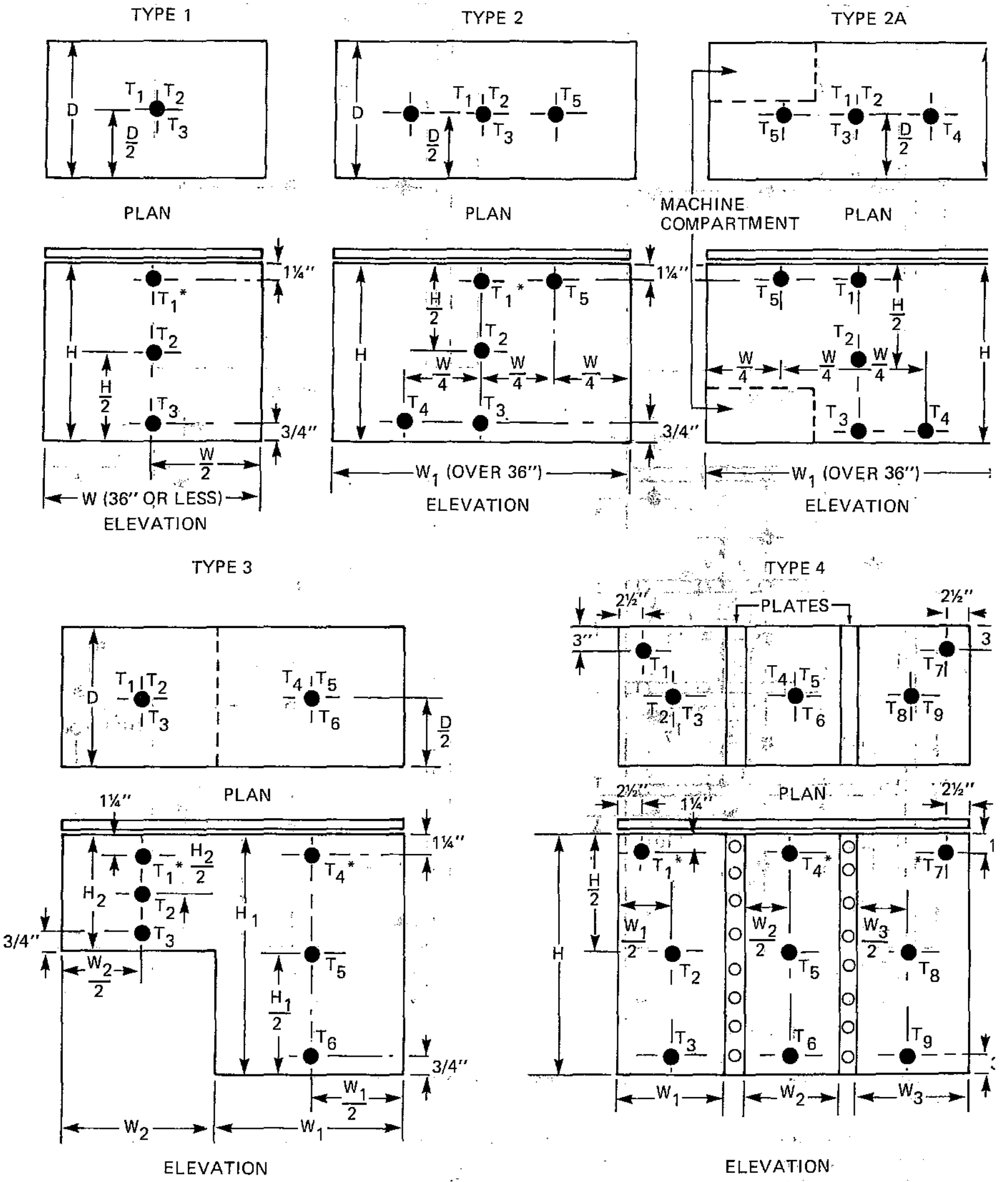
"A", "D", "E", "W", and "V" are aribtrary designations for determining location at which temperatures are to be measured. The depth dimension shall be measured from the back of the liner to a plane defining the gasket sealing surface. T_1, T_2, and T_3 indicate thermocouple locations.

Fig. 7-1

Thermocouple Locations for Determination of Fresh Food Compartment Temperatures

FIGURE 7–2

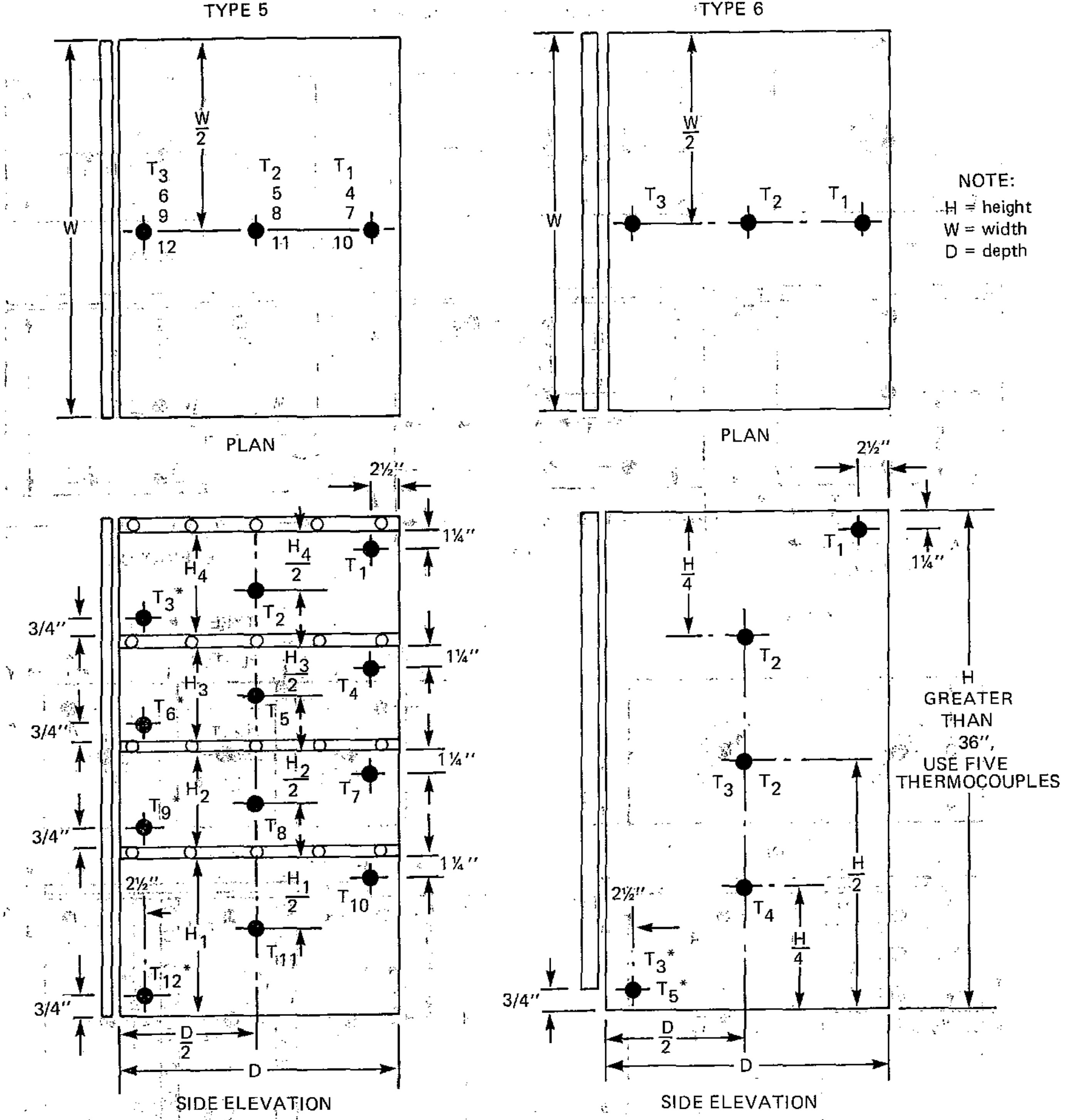
Thermocouple Locations For Determination Of Freezer Compartment Temperatures
Of Household Refrigerators and Household Freezers



Type 1, 2, and 3	Chest Freezer (lift cover) with refrigerated walls
Type 4	Chest Freezer (lift cover) with refrigerated plates
Type 5	Vertical Freezer (front door) with refrigerated shelves (door located at left)
Type 6	Evaporator or freezer compartment of Household refrigerators (except All – Refrigs.) or Vertical Freezers (front door) with refrigerated walls or with concealed evaporator (door located at left)

FIGURE 7–2 (Continued)

Thermocouple Locations For Determination Of Freezer Compartment Temperatures Of Household Refrigerators (Except All-Refrigerators) and Household Freezers



*If a projection on the inner door interferes with these thermocouple locations, move them rearward to clear the projection.

For types 1, 2, 3 and 4; the height dimension shall be measured from the bottom of the liner (or from top of a trivet, if furnished) to a plane defining the gasket sealing surface.
For types 5 and 6; the height dimension shall be measured from the bottom of the liner (or from top of a trivet, if furnished)
For types 5 and 6; the depth dimension shall be measured from the back of the liner to a plane defining the gasket sealing surface.
For type 5; non-refrigerated shelves are treated as if they were not there.

NOTE: For load tests, the thermocouple location designates the approximate geometric center of a 5 x 4 x 1½″ frozen food package.

FIGURE 7–3

Thermocouple Locations For Door Shelves Of Vertical Freezer And Door Shelves Of Freezer Compartment In Combination Refrigerator-Freezer

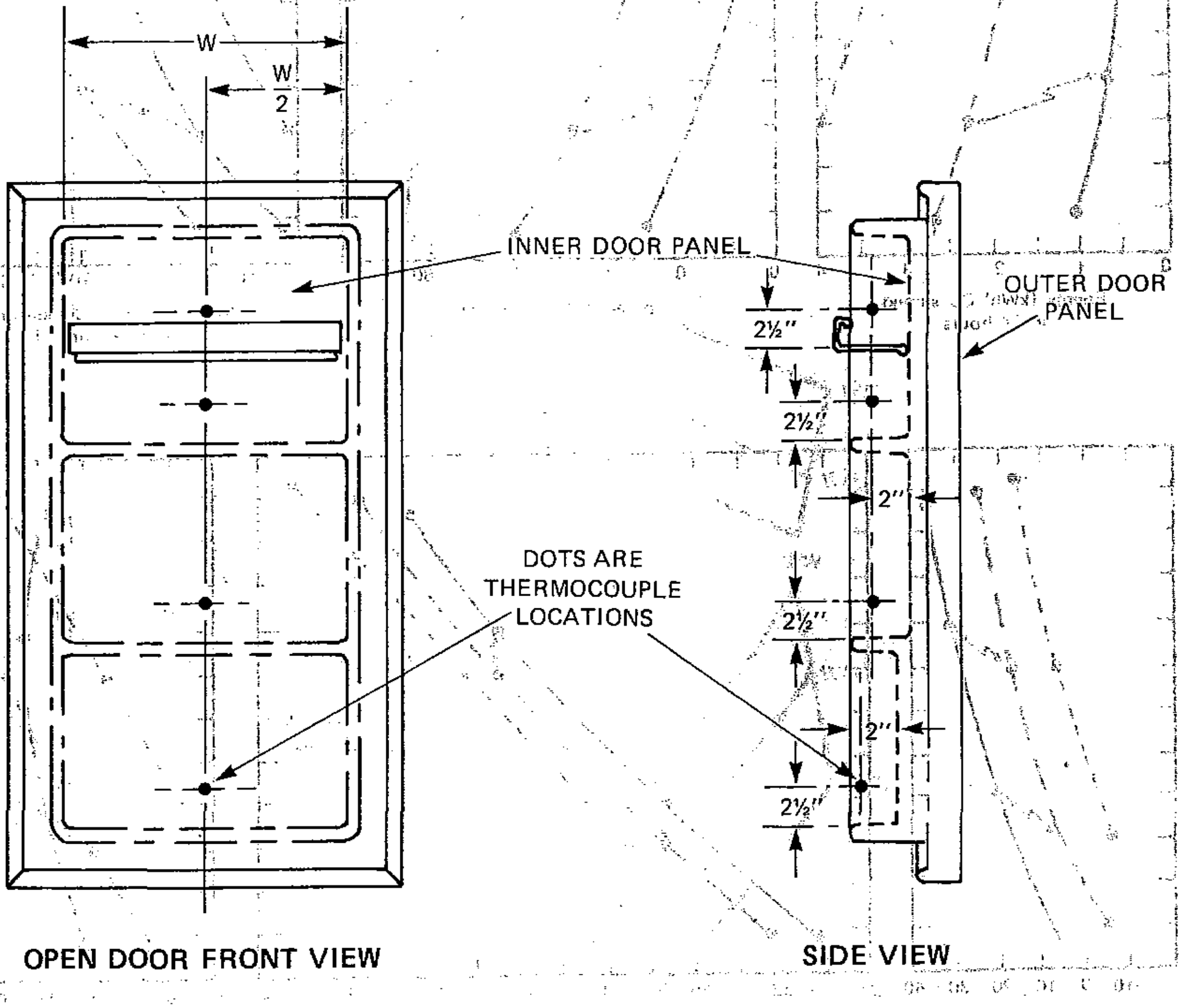
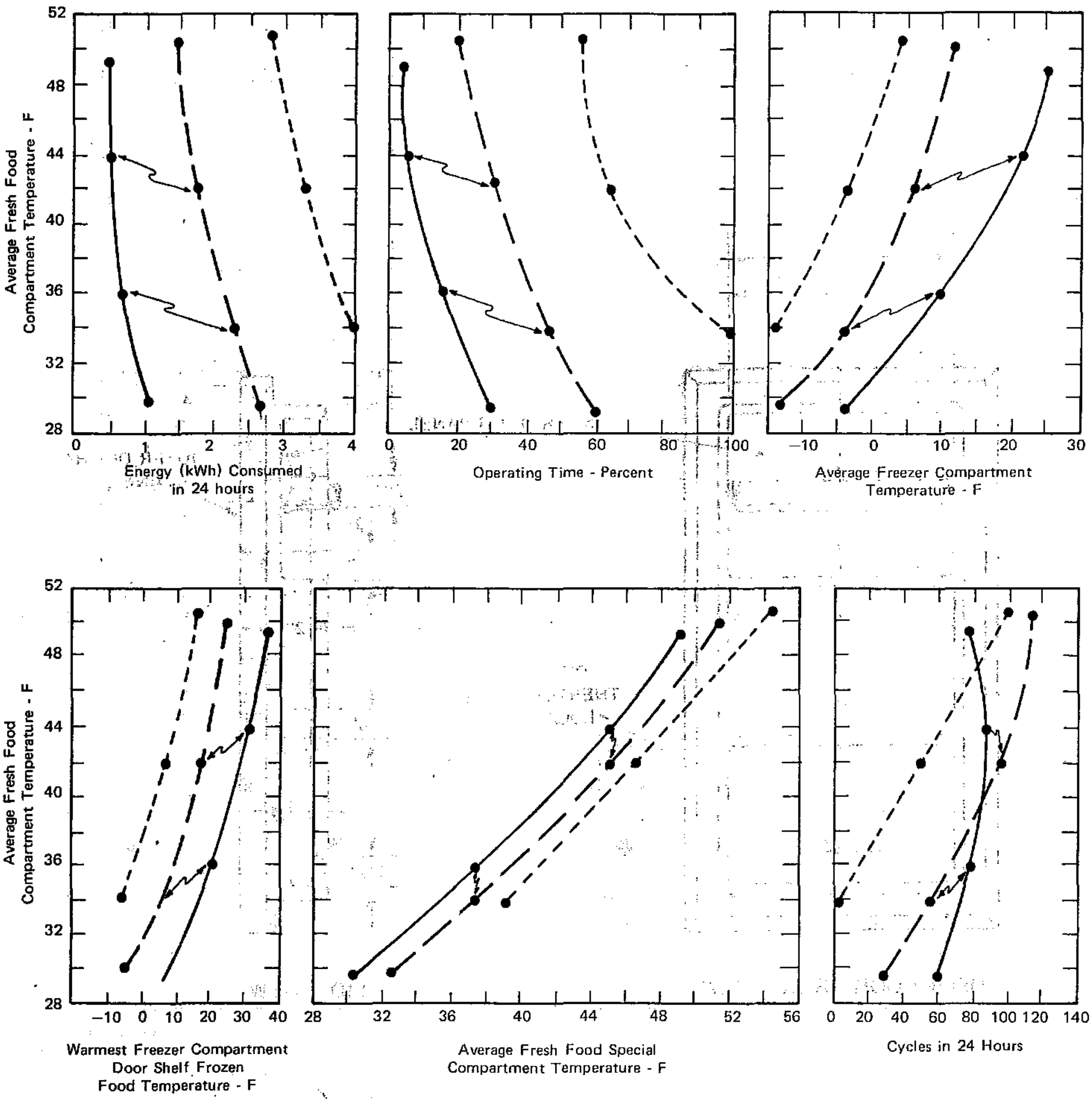


FIGURE 7–4

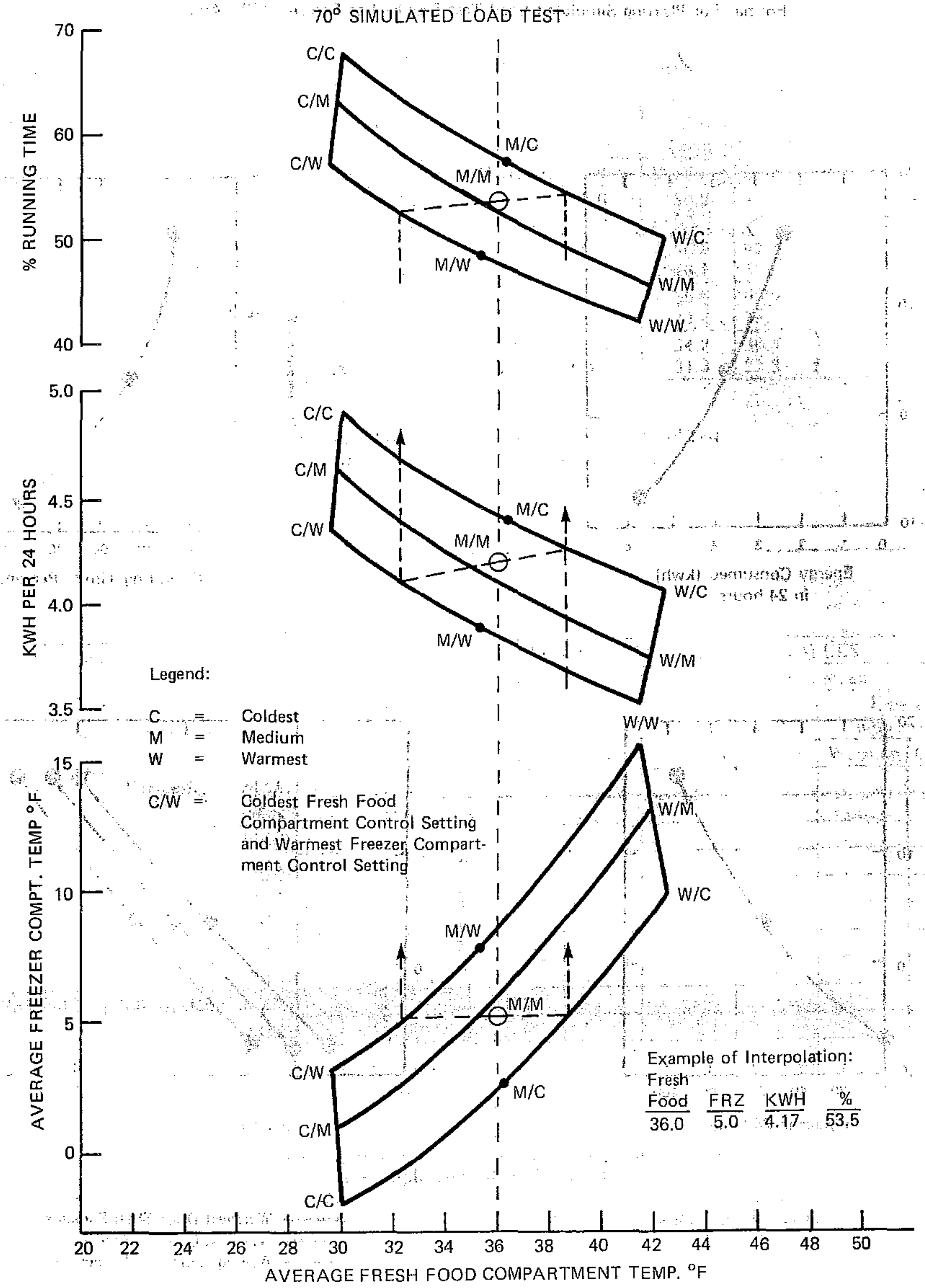
Format for Plotting Simulated Load Test Results For Single Control Cabinets



NOTE: Connecting lines between test points in the 70F and 90F ambients indicate they were run without resetting the control.

FIGURE 7–5

Format for plotting points and reading results for simulated load test. Multiple Control Cabinets Example shown is for 70F ambient.



Legend:

C = Coldest
M = Medium
W = Warmest

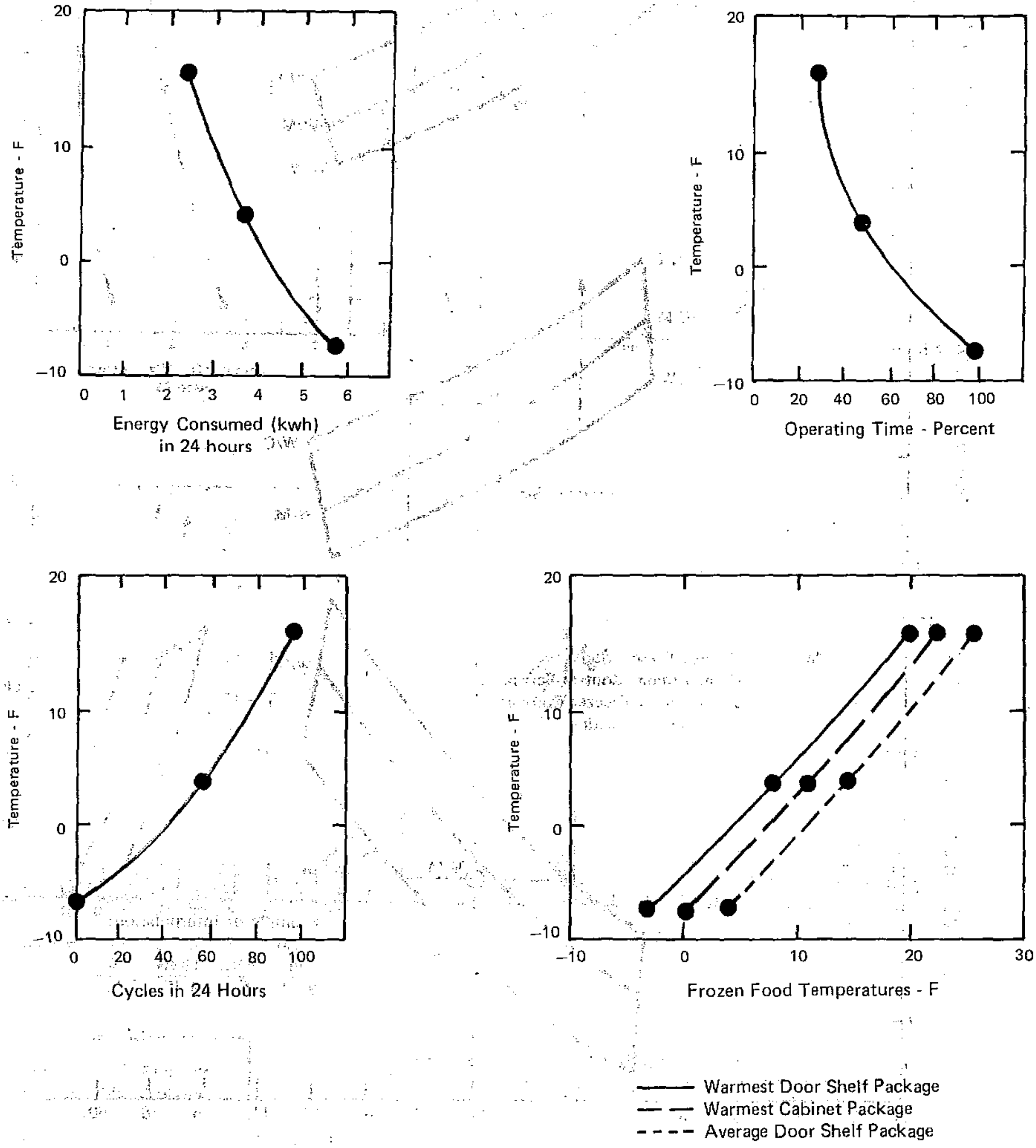
C/W = Coldest Fresh Food Compartment Control Setting and Warmest Freezer Compartment Control Setting

Example of Interpolation:

Fresh Food	FRZ	KWH	%
36.0	5.0	4.17	53.5

FIGURE 7–6

Format For Plotting Simulated Load Test Results For Freezers (90F Ambient)



CONTROL POSITION			MAXIMUM/MINIMUM TEMPERATURE VALUES							
			70°F Ambient				90°F Ambient			
Freezer Compartment	Fresh Food Compartment		Fresh Food Compartment		Freezer Compartment		Fresh Food Compartment		Freezer Compartment	
			Warmest	Coldest	Warmest	Coldest	Warmest	Coldest	Warmest	Coldest
None	Warmest	MAX.	53.1	50.6	32.0	27.6	54.8	48.9	18.6	12.3
		MIN.	51.5	47.2	28.5	23.0	52.1	46.1	14.2	9.0
None	Intermediate	MAX.	47.3	44.8	29.5	26.2	46.3	42.2	13.4	8.8
		MIN.	45.3	41.6	28.3	21.5	43.1	38.9	10.6	5.4
None	Intermediate (Optional)	MAX.	39.1	37.2	18.7	12.4	36.6	32.0	4.4	−5.1
		MIN.	36.6	33.4	14.5	8.5	33.4	29.1	1.2	−8.2
None	Coldest	MAX.	32.3	30.1	8.2	−2.4	34.2	30.4	−4.6	−12.2
		MIN.	28.7	26.5	3.9	−6.3	31.3	27.3	−7.2	−14.1

Fig. 7-7
Format with Sample Data for Tabulating Simulated Load Test Temperature Values for Single Control Refrigerators

CONTROL POSITION			MAXIMUM/MINIMUM TEMPERATURE VALUES							
			70°F Ambient				90°F Ambient			
Freezer Compartment	Fresh Food Compartment		Fresh Food Compartment		Freezer Compartment		Fresh Food Compartment		Freezer Compartment	
			Warmest	Coldest	Warmest	Coldest	Warmest	Coldest	Warmest	Coldest
Warmest	Warmest	MAX.								
		MIN.								
Warmest	Coldest	MAX.								
		MIN.								
Coldest	Coldest	MAX.								
		MIN.								
Coldest	Warmest	MAX.								
		MIN.								
Warmest	Intermediate	MAX.								
		MIN.								
Coldest	Intermediate	MAX.								
		MIN.								

Fig. 7-7A
Format for Tabulating Simulated Load Test Temperature Values for Multiple Control Refrigerators

The cabinet(s) is to be packed and crated in accordance with the manufacturer's instructions.

8.2.3 Test Procedure. The crated cabinet is to be placed in an ambient temperature of 70-90°F (21.1-32.2°C) for a minimum of 24 hours and then is to be placed in one of the test ambients for at least 12 hours. At the end of this test period the cabinet is to be placed on the test floor and subjected to the following test to be conducted during the next hour. The cabinet is to again be placed in an ambient temperature of 70-90°F (21.1-32.2°C) for a minimum of 24 hours and then is to be placed in the other test ambient for at least 12 hours and the tests repeated. If desired, a separate cabinet may be used at each ambient temperature.

8.2.3.1 One side of the crated cabinet(s) is to be raised 6 inches (15.2cm) from the floor and suddenly released. This procedure is to be repeated for the other three sides.

8.2.3.2 The cabinet(s) is then to be unpacked, operated, and all accessible parts examined for damage.

8.2.4 Data To Be Reported.

(a) Type, model number, serial number, if any, and manufacturer or brand name of cabinet.

(b) Ambient temperatures.

(c) Damage observed as determined from visual inspection and operation.

8.3 External Surface Condensation Test (Household Refrigerators and Household Freezers).

8.3.1 Purpose. The purpose of this test is to determine the extent of condensation of water on the external surface of the cabinet under ambient conditions of high relative humidity.

8.3.2 Test Conditions. The general test conditions are to be in accordance with Paragraphs 7.2, 7.3, and 7.4.

The ambient temperature is to be 90°F ± 2 (32.2°C ± 1.1) dry bulb and the relative humidity is to be 75% ± 2.

The cabinet is to be prepared with its shelves and accessories in place in accordance with the manufacturer's instructions but without food and ice load. Cabinet surfaces should be free of all soil, tape, dirt, dust, oil and other foreign matter.

Anti-condensation heaters, if provided, are to be set at the highest heat position.

The temperature control(s) is to be set to maintain the following temperatures:

Household Refrigerator, average fresh food compartment temperature 38°F ± 2 (3.3°C ± 1.1).

Combination Refrigerator-Freezer — Multiple Control, average freezer compartment temperature 5°F ± 2 (−15°C ± 1.1).

Household Freezer, average freezer compartment temperature 0°F ± 2 (−17.8°C ± 1.1).

8.3.3 Test Procedure. The cabinet is to be placed in the test room and operated until the average temperatures in the fresh food and freezer compartments have reached steady state condition.

After steady state condition has been attained, carefully wipe dry all exterior surfaces of the cabinet with a clean cloth and continue the test period for an additional four hours.

During this test period, the surface areas exhibiting fog, droplets, and running water (see Figure 8-1) are to be outlined on the exterior surfaces and designated with the letters F, D, and R respectively.

8.3.4 Data To Be Reported.

(a) Type, model number, serial number, if any, and manufacturer or brand name of cabinet.

(b) Ambient temperature.

(c) Ambient relative humidity.

(d) Voltage and frequency.

(e) Average fresh food compartment temperature (if applicable).

(f) Average freezer compartment temperature (if applicable).

(g) Coded sketch showing maximum area and degree of condensation (see Figures 8-2a through e) that appears during the test period.

NOTE: Surface condensation of the types F (fog) and D (droplets) are generally acceptable to the consumer; running droplets are not.

8.4 Internal Moisture Accumulation Test (Household Refrigerators and Household Freezers).

8.4.1 Purpose. The purpose of this test is to determine under severe operating conditions the moisture accumulation within the insulation spaces and on the refrigerated surface in the cabinet and the effectiveness of defrost water disposal (if applicable).

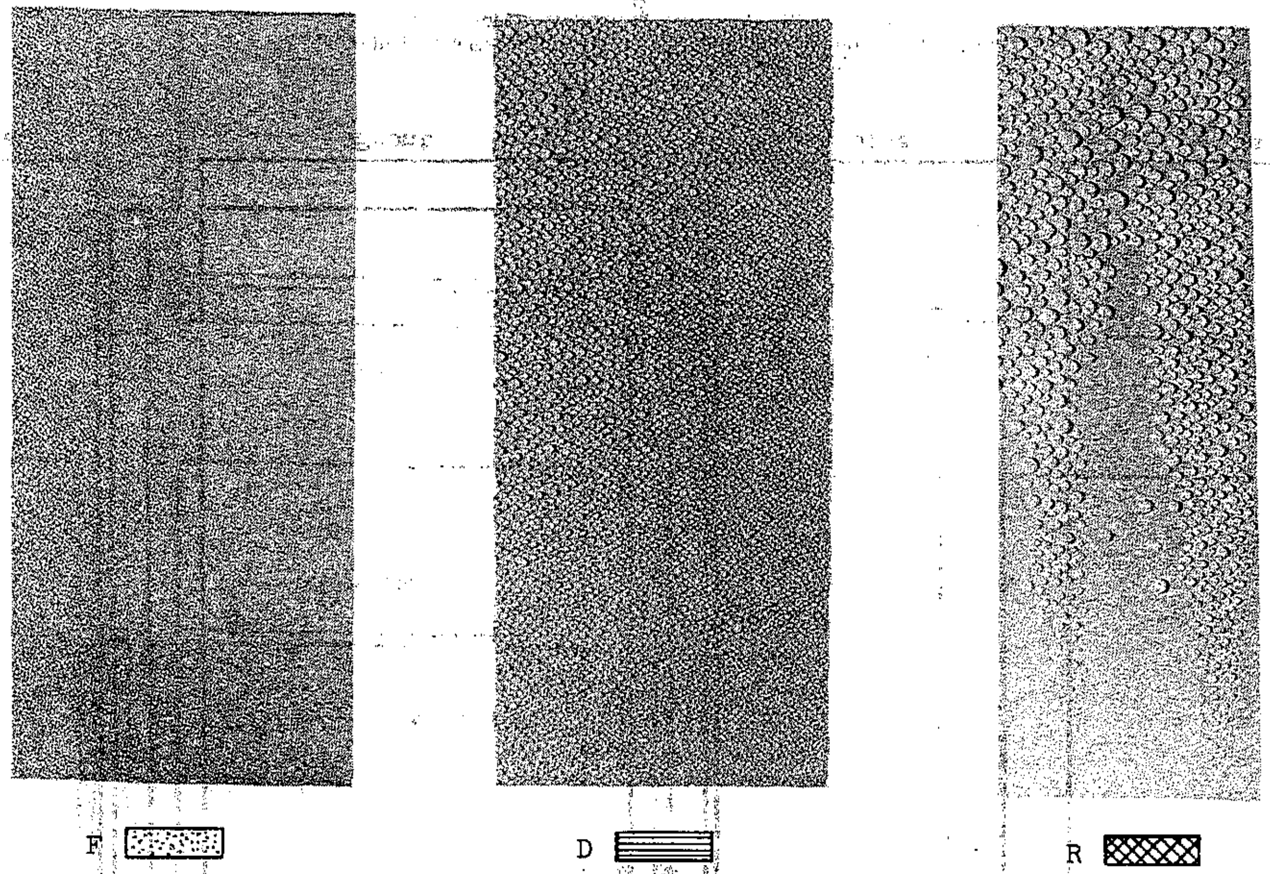
8.4.2 Test Conditions. The general test conditions are to be in accordance with Paragraphs 7.2, 7.3, and 7.4.

The ambient temperature is to be 90°F ± 2 (32.2°C ± 1.1) dry bulb, and the ambient humidity is to be 75% ± 2.

The cabinet is to be prepared with its shelves and accessories in place in accordance with the manufacturer's instructions but without food and ice load.

All defrost controls are to be operative during the test.

8.4.3 Test Procedure. The test period is to be started after the cabinet has reached steady state condition with the control(s) set to maintain the following temperatures:



F -Fog pattern consisting of a hazy appearance of the gloss surface and minute droplets of water uniformly spaced, usually appearing at dew point and/or usually occurring at not more than three degrees below dew point.

D - Medium-sized droplets of water formed after coalescence of F, without run-down, usually occurring between three and five degrees below dew point.

R - Large-sized droplets of water with heavy run-down, usually occurring at surface temperatures more than five degrees below dew point.

Fig. 8-1

Classification of Surface Condensation Patterns

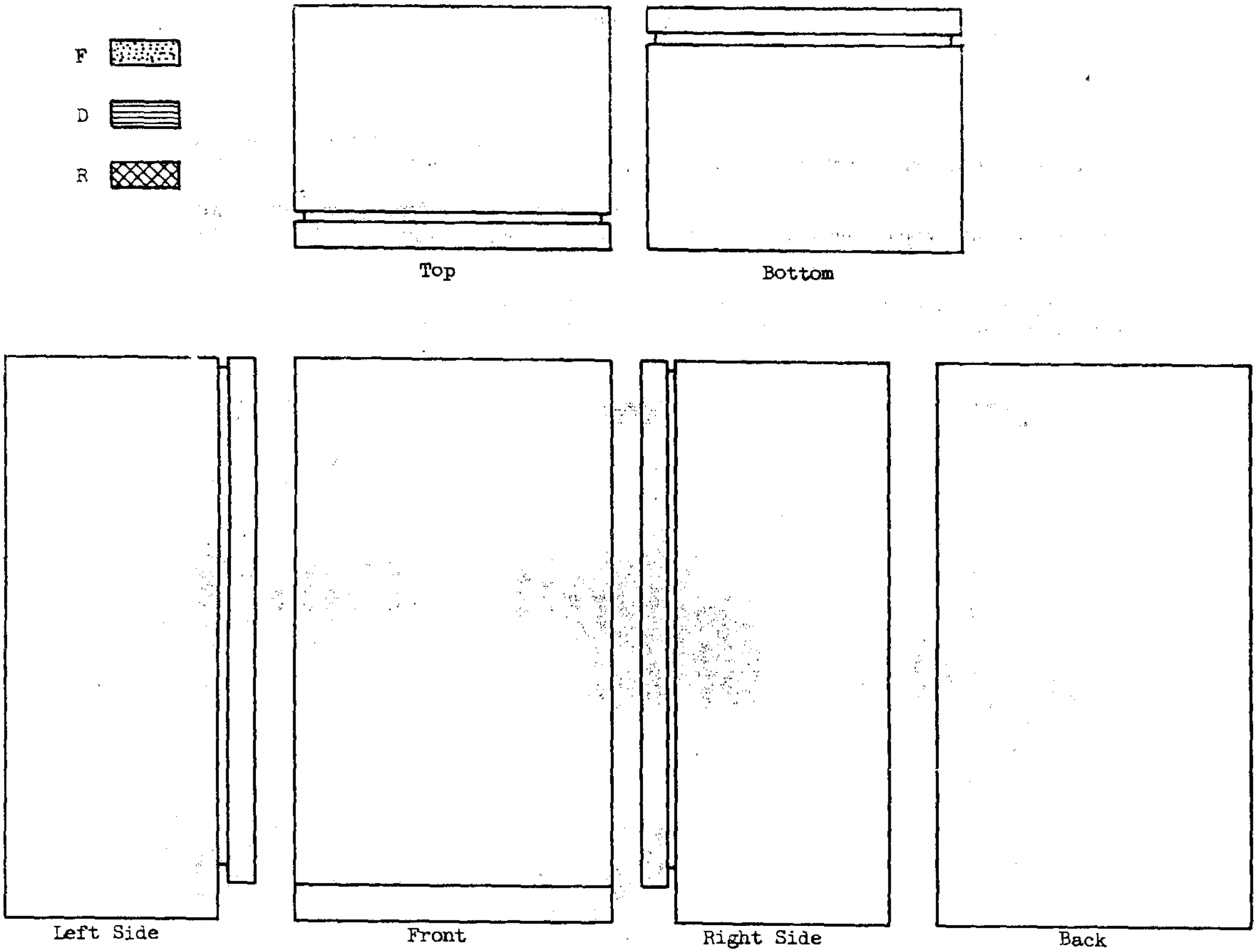


Fig. 8-2a

Format for Reporting External Surface Condensation Test Results — Single Door Cabinet
(90F and 75% Relative Humidity Ambient)

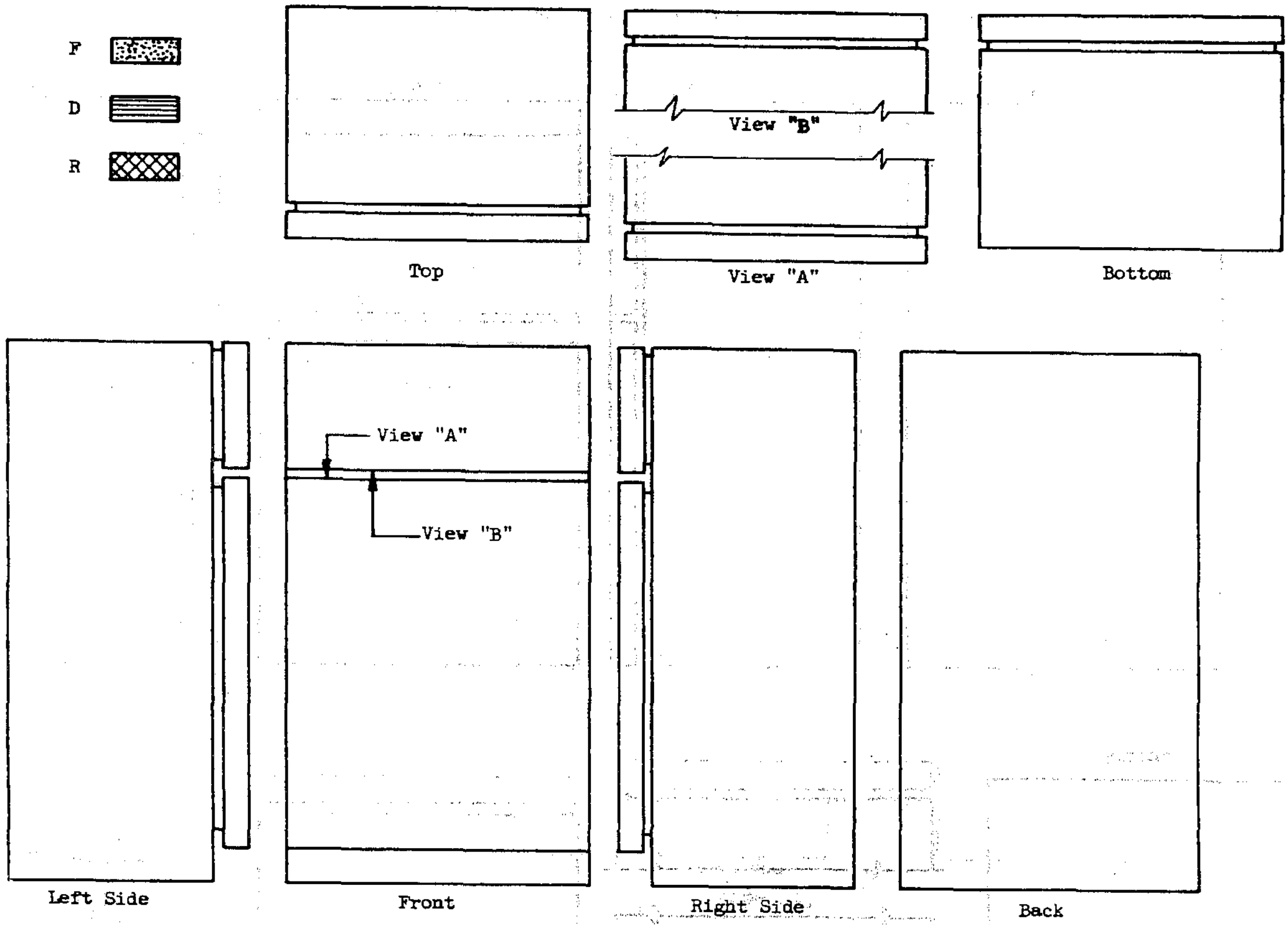


Fig. 8-2b

Format for Reporting External Surface Condensation Test Results— Two Door Cabinet–Top Freezer Compartment
(90F and 75% Relative Humidity Ambient)

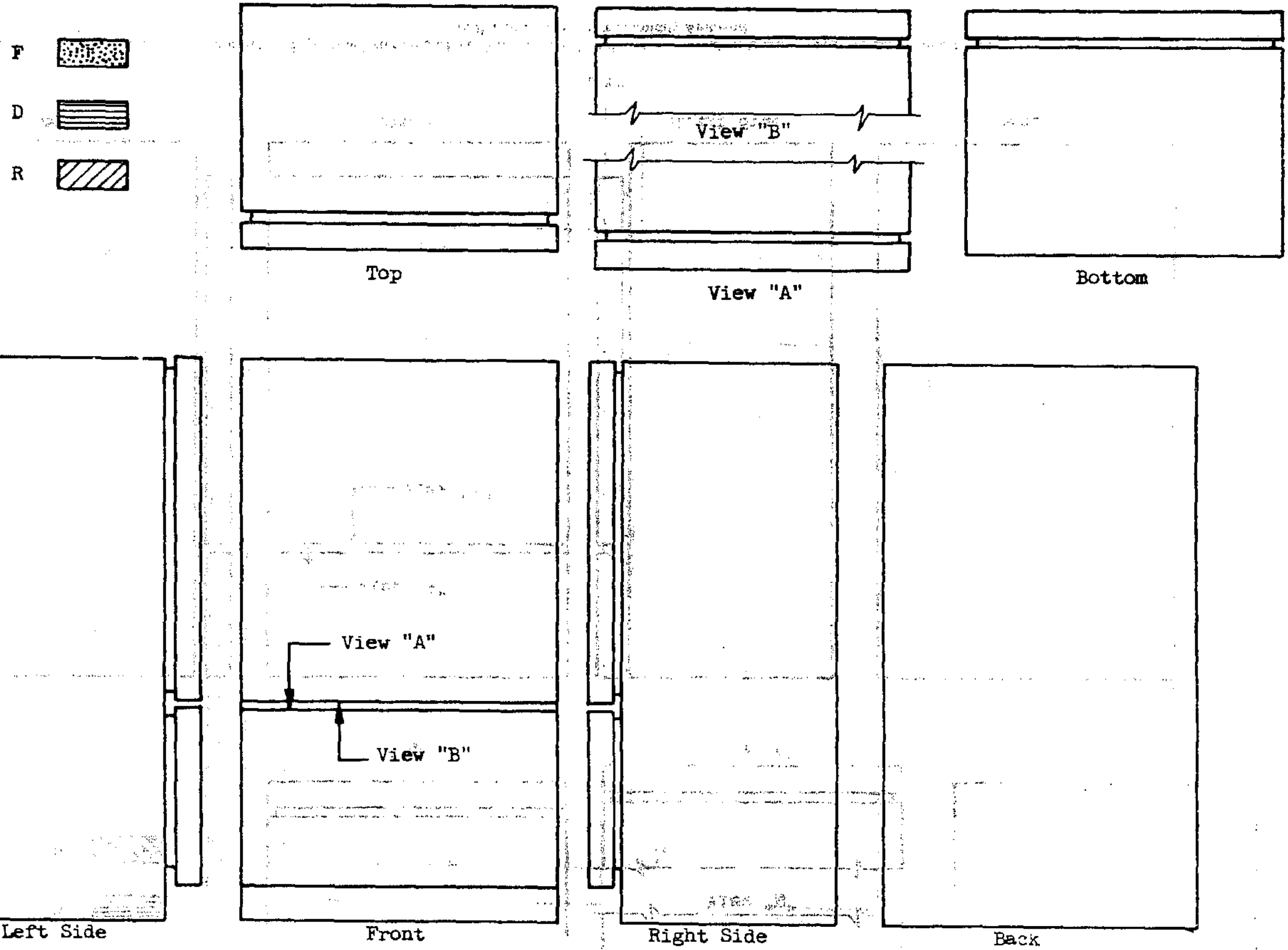


Fig. 8-2c

Format for Reporting External Surface Condensation Test Results — Two Door Cabinet - Bottom Freezer Compartment
(90F and 75% Relative Humidity Ambient)

(90F and 75% Relative Humidity Ambient)

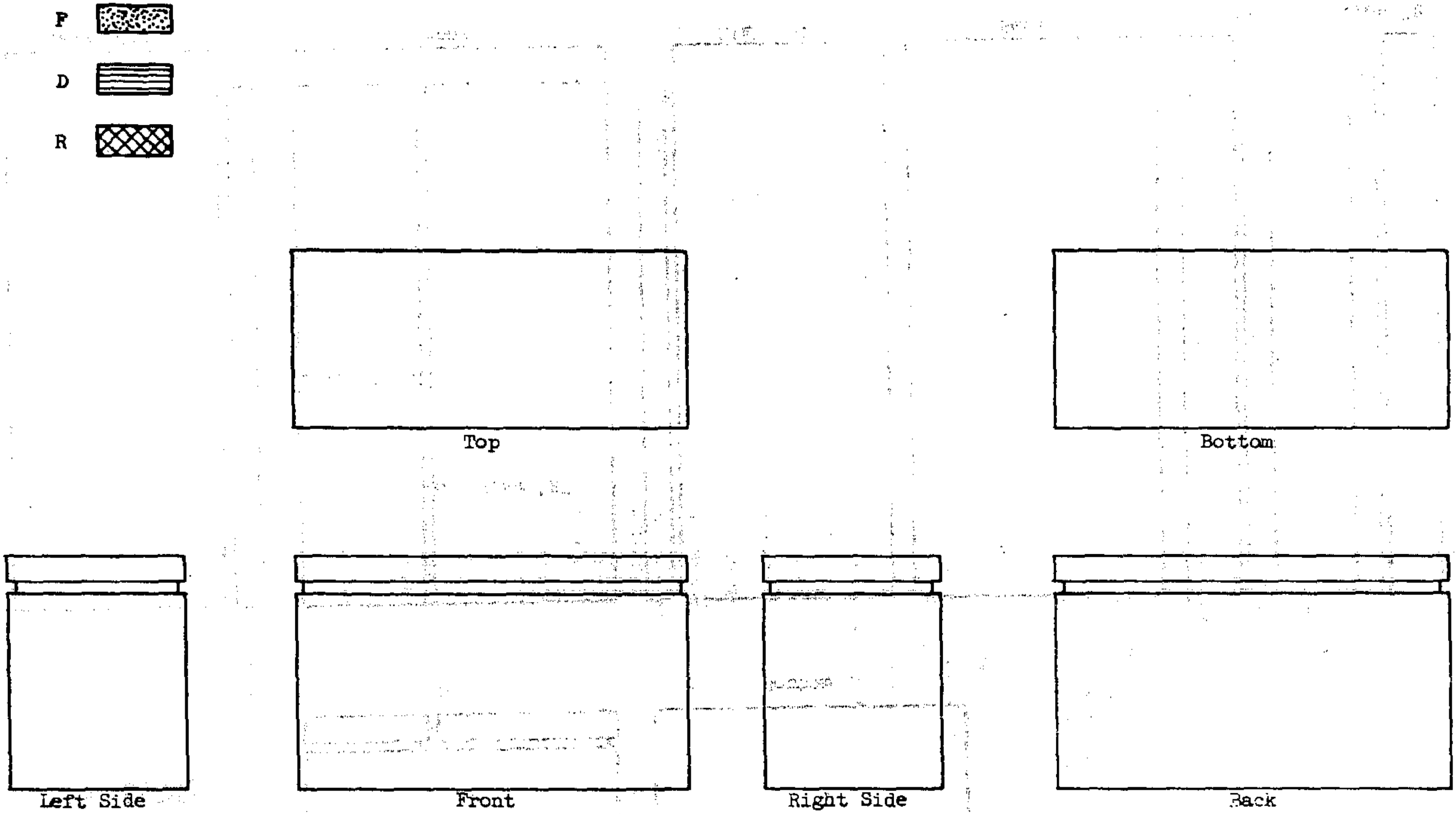


Fig. 8-2d

Format for Reporting External Surface Condensation Test Results — Horizontal Door Cabinet (Chest)
(90F and 75% Relative Humidity Ambient)

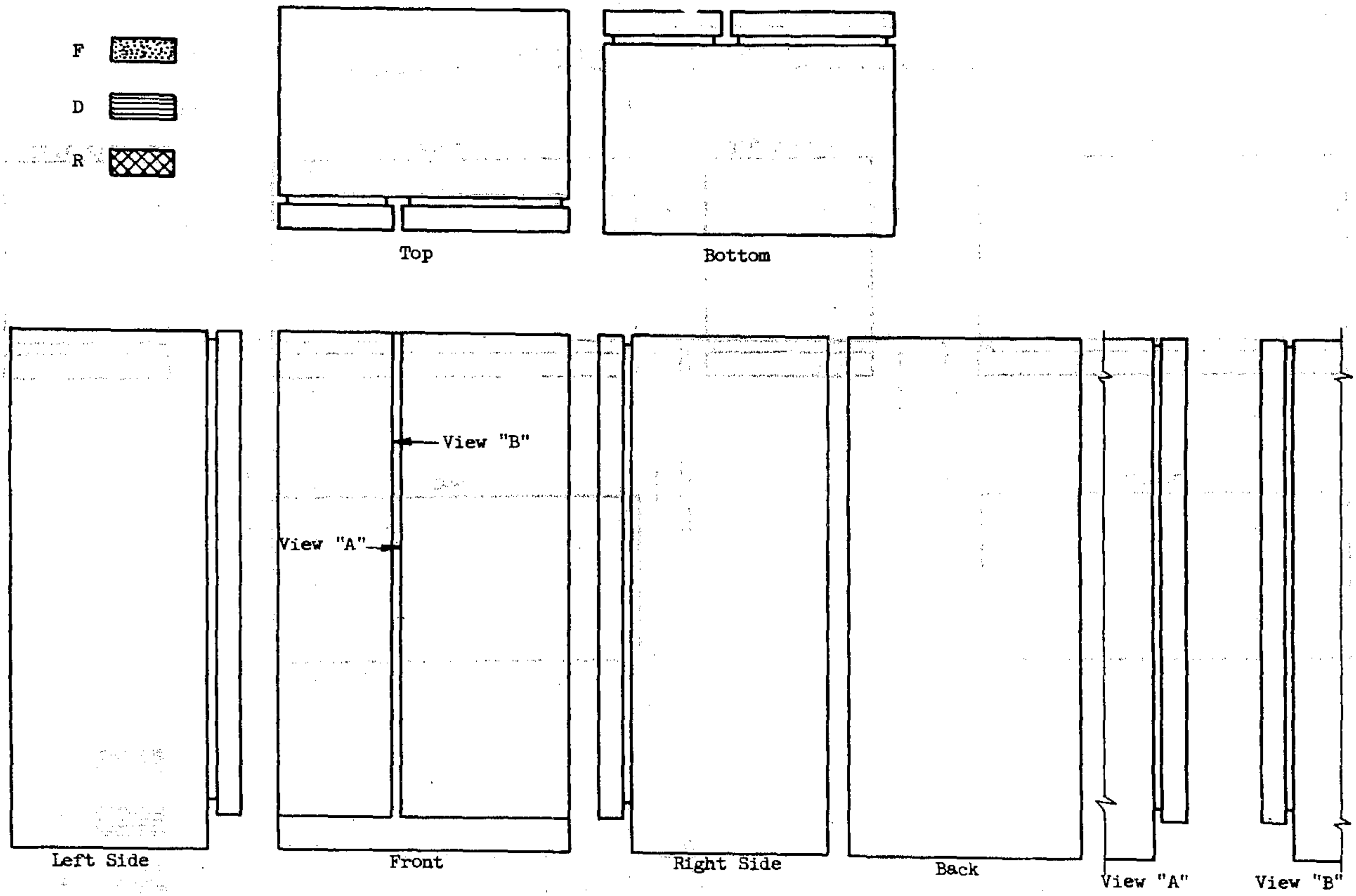


Fig. 8-2e

Format for Reporting External Surface Condensation Test Results — Two Door Side by Side Cabinet
(90F and 75% Relative Humidity Ambient)

The control settings are not to be changed during the test.

Household Refrigerator, average fresh food compartment temperature 38°F ± 2 (3.3°C ± 1.1).

Combination Refrigerator-Freezer — Multiple Control, average freezer compartment temperature 5°F ± 2 (−15°C ± 1.1).

Household Freezer, average freezer compartment temperature 0°F ± 2 (−17.8°C ± 1.1).

The test period is to be 21 days with the following door opening schedule practiced daily:

DAILY DOOR OPENINGS

Type of Cabinet	Fresh Food Compartment	Freezer Compartment
Basic Refrigerators and All-Refrigerators	96	—
Household Combination Refrigerator-Freezers	96	24
Household Freezers	—	24

Door openings are to be of 15 second duration each and uniformly spaced over the first 16 hours of each test day. The last 8 hours of each test day is to be a recovery period with no door openings. During all door openings and closings, the average velocity of the leading edge of the door is to be approximately 2 feet (60 cm) per second. The door(s) is to be opened at least 45 degrees and not more than 90 degrees.

Manual-defrosting and semi-automatic defrosting Household Refrigerators (not Combination Refrigerator-Freezers) are to be defrosted on an alternating 3 to 4 day schedule during the 21-day test period with the first defrost during the third or fourth 8-hour recovery period, whichever is desired. Combination Refrigerator-Freezers, Household Freezers and Partial Automatic Defrost Combination Refrigerator-Freezers are not to be defrosted during the 21-day test period.

If an exterior evaporating drain pan is provided for defrost water disposal, observations are to be made during the 21-day test period to determine if the pan overflows.

At the end of the 16-hour door opening period on the 21st day of the test period, the cabinet is to be tested for current leakage in accordance with ANSI C101.1.

At the end of the 21-day test period, the accessible refrigerated surfaces are to be immediately examined for the presence of ice and frost and description thereof recorded. The cabinet interior is to be wiped dry. The cabinet is then to be removed from the test room, disassembled as quickly as possible, and examined for water, and ice accumulated in the insulation and insulation spaces and on inaccessible refrigerated surfaces and description thereof recorded. Full thickness samples of insulation of at least 1 square foot (0.09 square meter) are to be taken from each of the following parts for determination of the water content in percent dry weight of insulation. If necessary, the cabinet is to be cut to obtain the insulation samples.

Insulation is to be taken from:

(a) The bottom of the cabinet.

(b) The back of the cabinet opposite the freezer compartment. If the freezer compartment is at the bottom of the cabinet, an additional back sample is to be obtained from within 18 inches (45.7 cm) of the top of the cabinet.

(c) One side of the cabinet adjacent to the breaker strip and next to the freezer compartment.

(d) Compartment doors at the bottom (for chest freezers take sample from approximate center of the lid).

(e) Other areas as desired.

8.4.4 Data To Be Reported.

(a) Type, model number, serial number, if any, and manufacturer or brand name of cabinet.

(b) Ambient relative humidity.

(c) Ambient temperature.

(d) Voltage and frequency.

(e) Fresh food compartment temperature at the start of the test.

(f) Freezer compartment temperature at the start of the test.

(g) Amount and location (sketch and/or photograph of ice and/or frost accumulation on refrigerated surfaces).

(h) Visible water or ice in insulation location.

(i) Degree and location of water on metallic surfaces, joints and seams that comprise the insulation space.

(j) Water content of each insulation sample, percent of dry weight.

(k) Drain pan overflow, if any.

8.5 Environmental Cracking Resistance Test (Household Refrigerators and Household Freezers).

8.5.1 Purpose. The purpose of this test is to determine the cracking resistance of the plastic compartment liners, door liners and breaker strips at operating temperature when coated with 50/50 mixture of oleic acid and cotton seed oil.

8.5.2 Test Conditions. The general test conditions are to be in accordance with Paragraphs 7.2, 7.3, and 7.4.

The ambient temperature is to be 70-90°F (21.1-32.2°C).

The cabinet is to be prepared with its shelves and accessories in place in accordance with the manufacturer's instructions but without food and ice load.

The cabinet temperature(s) during the test is to be:

Household Refrigerator, average fresh food compartment temperature 38°F ± 2 (3.3°C ± 1.1).

Combination Refrigerator-Freezer — Multiple Control, average freezer compartment temperature 5°F ± 2 (−15°C ± 1.1).

Household Freezer, average freezer compartment temperature 0°F ± 2 (−17.8°C ± 1.1).

The compartment shelves are to be uniformly loaded with food and beverage containers (milk, soda, etc.) as follows:

Compartment shelves — 10 inches (25.4 cm) or more in height — 40 pounds per square foot (195.5 Kg/m^2). Maximum per shelf — 100 pounds (488.8 Kg/m^2).

Compartment shelves — less than 10 inches (25.4 cm) in height — 20 pounds per square foot (97.8 Kg/m^2). Maximum per shelf — 100 pounds (488.8 Kg/m^2).

The door shelves are to be uniformly loaded with standard test loads as follows:

Full width door shelves — 10 inches (25.4 cm) or more in height are to be loaded at the extreme right and left sides respectively with a load cylinder whose height is 7½ inches (19.05 cm) and whose diameter is the largest given in Table 8-1 that will fit on the shelf. Additional 7½ inch high load blocks (see Table 8-1) equal in weight to the cylindrical end loads are to be added to the shelf to give a total minimum loading of 30 pounds per square foot (146.6 Kg/m^2).

Full width door shelves — less than 10 inches (25.4 cm) in height are to be loaded at the extreme right and left sides respectively with a load cylinder whose height is a minimum of 50% of the shelf height and whose diameter is the largest given in Table 8-1 that will fit on the shelf. Additional load blocks (see Table 8-1) equal in weight and height to the cylindrical end loads are to be added to the shelf to give a total minimum loading of 15 pounds per square foot (73.3 Kg/m^2).

Load cylinder and load block heights to be 7½ inches (19.05 cm) for shelves 10 inches (25.4 cm) or more in height.

Load cylinder and load blocks to be a minimum of 50% of the shelf height for shelves less than 10 inches (25.4 cm) high.

Butter or cheese compartments — 7 pounds per square foot (34.2 Kg/m^2).

Egg shelves — 0.20 pounds (0.98 Kg/m^2) per egg space.

8.5.3 Test Procedure. The cabinet is to be placed in the test room and operated until the average temperatures in the fresh food and freezer compartments have reached steady state condition.

After steady state condition has been attained, the exterior door liner, compartment liner (if plastic), and the breaker strips are to be completely coated with a thin film of 50/50 mixture of oleic acid and cotton seed oil, and the shelves are then to be loaded. Following this, the load cylinders at the extreme right and left of each door shelf are to be raised 2 inches (5.1 cm) and then dropped.

The door(s) is then to be closed and the cabinet continued to be operated.

After two hours of cabinet operation, the door(s) is to be slammed 12 times at a rate of about 2 feet (0.6 meters) per second at the leading edge of the door.

The door(s) is to be slammed and the load cylinders dropped once each 24 hours as described above.

The compartment(s) and door liner(s) and the breaker strips are to be examined for cracks and crazing daily until the test is terminated. The test may be adjusted to

TABLE 8-1

Load Cylinder Diameter In Inches	Load Block Width × Depth Inches	Load Cylinder & Load Block Lower End Chamfer 45° ×	Weights For Shelves Under 10" High	Weights For Shelves 10" High Or Greater
1	1 × 1	¼	.10 Lbs.	.21 Lbs.
2	2 × 2	½	.42 Lbs.	.84 Lbs.
3	3 × 3	½	.94 Lbs.	1.88 Lbs.
4	4 × 4	½	1.67 Lbs.	3.34 Lbs.
5	5 × 5	½	2.10 Lbs.	5.21 Lbs.
6	6 × 6	½	3.75 Lbs.	7.50 Lbs.

normal work schedule.

8.5.4 Data To Be Reported.

(a) Type, model number, serial number, if any, and manufacturer or brand name of cabinet.

(b) Ambient temperatures.

(c) Average fresh food compartment temperature (if applicable).

(d) Average freezer compartment temperature (if applicable).

(e) Location and length of cracks and crazing found in door inner liner(s).

(f) Location and length of cracks or crazing found in breaker strips.

(g) Location and length of cracks and crazing found in compartment liner(s).

8.6 Bottom Breaker Strip(s) Impact Test (Household Refrigerators and Household Freezers).

8.6.1 Purpose. The purpose of this test is to determine the impact resistance of the bottom breaker strip(s) at operating temperature.

8.6.2 Test Conditions. The general test conditions are to be in accordance with Paragraphs 7.2, 7.3, and 7.4.

The ambient temperatures are to be 70-90°F (21.1-32.2°C).

The cabinet is to be prepared with its shelves and accessories in place in accordance with the manufacturer's instructions but without food and ice load.

The cabinet temperature(s) during the test is to be:

Household Refrigerator, average fresh food compartment temperature 38°F (3.3°C ± 1.1).

Combination Refrigerator-Freezer — Multiple Control, average freezer compartment temperature 5°F ± 2 (– 15°C ± 1.1).

Household Freezer, average freezer compartment temperature 0°F ± 2 (– 17.8°C ± 1.1).

A 2 pound (0.91 kg) dart or tup having a ½ inch (1.3 cm) spherical radius hardened steel point is to be used to impact or strike the breaker strip as assembled in the cabinet.

8.6.3 Test Procedure. The cabinet is to be placed in the test room and operated until the average temperature in the fresh food and freezer compartments have reached steady state conditions.

After 3 hours of operation at steady state condition, open the door(s) and drop the dart or tup onto the bottom breaker strip(s) impacting toward the center of the span and width. Start with a drop of 5 inches (12.7 cm) and then increase with successive drops at 5 inch (12.7 cm) increments until failure occurs or the maximum height of the compartment, whichever is lesser, is achieved. Move the location of impact for each drop along the breaker strip with no impact closer than approximately 2 inches (5.1 cm) to a preceding impact. If the strip visibly cracks before maximum drop is achieved, stop the test and report the results.

All drops are to be performed within one minute after the door is opened.

The dart or tup is to impact the breaker strip only once with each drop.

8.6.4 Data To Be Reported.

a) Type, model number, serial number, if any, and manufacturer or brand name of cabinet.

(b) Ambient temperature.

(c) Voltage and frequency.

(d) Average fresh food compartment temperature (if applicable).

(e) Average freezer compartment temperature (if applicable).

(f) Location and size of cracks and crazing and impact value in inch-pounds (kilogram-meters).

9. METHOD OF DETERMINING THE ENERGY CONSUMPTION AND FREEZER TEMPERATURE OF HOUSEHOLD REFRIGERATORS AND HOUSEHOLD FREEZERS

9.1 Scope of Section 9. This section describes a standard method for determining the electrical energy consumption and the average freezer temperature of Household Refrigerators and Household Freezers.

9.2 Purpose. The purpose of this test is to establish a uniform and repeatable procedure for measuring electrical energy consumption and freezer temperature under various control positions and provide a standard method for reporting estimated average monthly energy consumption and average freezer temperature.

9.3 General Test Conditions. The general test conditions are to be in accordance with Paragraphs 7.2, 7.3, and 7.4.

When an anti-sweat heater switch(es) is provided, the energy consumption tests are conducted with the switch(es) in both the lowest energy consuming position and the highest energy consuming position. For this test, defrost controls are to be operative.

9.4 Test Procedure. The cabinet door(s) is to remain closed during each test period. Operate the cabinet in an ambient temperature of 90°F (32°C) at each of the following control positions:

9.4.1 For single control household refrigerators, combination refrigerator-freezers and freezers:

(a) Warmest indicated position on the control knob (not defrosting), *NOTE: When a freezer control does not have a warm position indicated on the control and the last marked position results in an Average Freezer Compartment temperature below 0 °F (−17.8 °C), and the control has the capability of being set at a position warmer than the last marked position, the control should be set in the warmer direction such that the Average Freezer Compartment temperature is greater than 0 °F (−17.8 °C) in order to establish the warmest point of operation.*

(b) Coldest indicated position on the control knob (not short circuited),

(c) An intermediate position on the control (approximately midway between warmest and coldest).

9.4.2 For multiple control household combination refrigerator-freezers:

(a) With the primary control set at the warmest position on the control knob, set the secondary control at the

(i) Warmest indicated position on the control knob,

(ii) Coldest indicated position on the control knob.

(b) With the primary control set at the coldest position on the control knob, set the secondary control at the

(i) Warmest indicated position on the control knob,

(ii) Coldest indicated position on the control knob.

NOTE: The primary control is that device which initiates compressor operation.

For no-frost type refrigerators and freezers after steady state conditions have been reached, each test period for determination of energy consumption is to be from the initiation of the recovery period after defrost to the initiation of the next recovery period, or in multiples of this test period. Determine temperatures from an equal number of off and on periods of the compressor motor during the three hours prior to initiation of defrost.

For partial automatic defrost (cycle defrost) refrigerators and manual defrost refrigerators and freezers, temperatures are determined from an equal number of off and on periods of the compressor motor during a three hour period beginning after steady state conditions have been reached. After steady state conditions have been reached, each test period for determination of energy consumption is to be at least two whole cycles (i.e., an equal number of off and on periods of the compressor motor, if cycling occurs) and not less than three hours. If no cycling or incomplete cycling occurs in the three hour period, test should be continued for up to 24 hours in order to assure accuracy of temperature and energy consumption data.

The average compartment temperature is defined as the average of the temperature readings taken during a complete cycle of the temperature controller for that compartment (excluding temperatures on the compartment doors), or, if no cycling or incomplete cycling occurs,

(1) The average over the three hour period prior to defrost for automatic defrost units.

(2) The average over the three hour period prior to the end of the test period for non-automatic defrost units.

For household refrigerators and combination refrigerator-freezers, with the data obtained at each of the settings of the temperature control(s), plot curves (show actual data points when plotting) for the average fresh food compartment temperature versus:

(1) Energy (kWh) consumed per 24 hours.

(2) Average freezer compartment temperature.

For household freezers, with the data obtained at each of the settings of the temperature control, plot a curve (show actual data points when plotting) for the average freezer compartment temperature versus energy (kWh) consumed per 24 hours.

9.5 Determination of Results.

9.5.1 Average Freezer Compartment Temperature at 38 °F (3 °C) Average Fresh Food Compartment Temperature.

9.5.1.1 For single control household refrigerators, this is a single point along the temperature curve and is reported as the "Average Freezer Compartment Temperature" (see Figures 9-1, 9-2, and 9-3).

9.5.1.2 For multiple control combination refrigerator-freezers, the 38 °F (3 °C) average fresh food compartment temperature intersects the temperature curves at two places. Determine the highest freezer temperature intersected as the "Maximum Average Freezer Compartment Temperature" and the lowest freezer temperature intersected as the "Minimum Average Freezer Compartment Temperature" (see Figure 9-4). If a 38 °F (3 °C) average fresh food compartment temperature cannot be obtained regardless of the settings of the temperature control(s), the "special case" temperature values are to be used to determine unit energy consumption. See the applicable procedure in subsection 9.5.2.

9.5.2 Energy Consumption.

9.5.2.1 For all refrigerators, determine energy consumption as the kWh consumed per 24 hours at 38 °F (3 °C) average fresh food compartment temperature (see Figure 9-1).

9.5.2.1.1 When the average fresh food compartment temperature is always less than 38 °F (3 °C), determine energy consumption as the kWh consumed per 24 hours at the highest attainable average fresh food compartment temperature (see Figure 9-1A).

9.5.2.1.2 When the average fresh food compartment temperature is always greater than 38°F (3°C), determine energy consumption as the kWh consumed per 24 hours corresponding to 38°F (3°C) by extrapolating the energy consumption temperature curve to 38°F (3°C) average fresh food compartment temperature (see Figure 9-1B).

9.5.2.2 For single control basic refrigerators, determine energy consumption as the kWh consumed per 24 hours at 15°F (−9°C) average freezer compartment temperature (see Figure 9-2).

9.5.2.2.1 When the average freezer compartment temperature is always less than 15°F (−9°C), determine the energy consumption as the kWh per 24 hours corresponding to the highest attainable freezer compartment temperature or 45°F (7°C) fresh food compartment temperature, whichever is the greater.

9.5.2.2.2 When the average freezer compartment temperature is always greater than 15°F (−9°C), determine the energy consumption as the kWh per 24 hours corresponding to 15°F (−9°C) by extrapolating the temperature and energy curves to 15°F (−9°C) average freezer compartment temperature, provided the corresponding fresh food compartment temperature is 45°F (7°C) or below (see Figure 9-2A). If the extrapolated curves indicate a fresh food compartment temperature greater than 45°F (7°C) at the 15°F (−9°C) average freezer compartment temperature, the curves are further extrapolated and the energy consumption determined as the kWh per 24 hours corresponding to the 45°F (7°C) fresh food compartment temperature.

9.5.2.3 For single control combination refrigerator-freezers, determine energy consumption as the kilowatt hours (kWh) consumed per 24 hours at 5°F (−15°C) average freezer compartment temperature (see Figure 9-3).

9.5.2.3.1 When the average freezer compartment temperature is always less than 5°F (−15°C), determine energy consumption as the kWh per 24 hours at the highest freezer temperature attainable or at 45°F (7°C) fresh food compartment temperature, whichever is the greater (see Figures 9-3A and 9-3B).

9.5.2.3.2 When the average freezer compartment temperature is always greater than 5°F (−15°C), determine the energy consumption as the kWh per 24 hours corresponding to 5°F (−15°C) by extrapolating the temperature and energy consumption curves to 5°F (−15°C) average freezer compartment temperature, provided the corresponding fresh food compartment temperature is 45°F (7°C) or below (see Figure 9-3C). If the extrapolated curves indicate a fresh food compartment temperature greater than 45°F (7°C) at the 5°F (−15°C) average freezer compartment temperature, the curves are further extrapolated and the energy consumption determined as the kWh per 24 hours corresponding to the 45°F (7°C) fresh food compartment temperature.

9.5.2.4 Household Refrigerators with a fixed temperature control are tested at the fixed control position and with the control short-circuited so that two test points are obtained.

9.5.2.4.1 For all refrigerators, energy consumption is determined as the kWh per 24 hours at the point where the straight line between the two test points crosses the 38°F (3°C) average fresh food compartment temperature line.

If the average fresh food compartment temperature is always less than 38°F (3°C), the energy consumption is determined as the kWh per 24 hours corresponding to the highest attainable fresh food compartment temperature.

If the all-refrigerator operates 100% of the time at its fixed control position and the average fresh food compartment temperature is always greater than 38°F (3°C), the energy consumption is determined as the kWh per 24 hours corresponding to 38°F (3°C) average fresh food compartment temperature by extrapolating a straight line from the test point and a point on the energy consumption-temperature plot corresponding to 0 kWh per 24 hours at 90°F (32°C) average fresh food compartment temperature.

9.5.2.4.2 For basic refrigerators, energy consumption is determined as the kWh per 24 hours at the point where the straight line between the two test points crosses the 15°F (−9°C) average freezer compartment temperature line.

If the average freezer compartment temperature is always less than 15°F (−9°C), the energy consumption is determined as the kWh per 24 hours corresponding to the highest attainable freezer compartment temperature.

If the basic refrigerator operates 100% of the time at its fixed control position and the average freezer compartment temperature is always greater than 15°F (−9°C), the energy consumption is determined as the kWh per 24 hours corresponding to 15°F (−9°C) average freezer compartment temperature by extrapolating a straight line from the test point and a point on the energy consumption-temperature plot corresponding to 0 kWh per 24 hours at 90°F (32°C) average freezer and fresh food compartment temperature.

9.5.2.4.3 For combination refrigerator-freezers, energy consumption is determined as the kWh per 24 hours at the point where the straight line between the two test points crosses the 5°F (−15°C) average freezer compartment temperature line.

If the average freezer compartment temperature is always less than 5°F (−15°C), the energy consumption is determined as the kWh per 24 hours corresponding to the highest attainable freezer compartment temperature.

If the combination refrigerator-freezer operates 100% of the time at its fixed control position and the average freezer compartment temperature is always greater than 5°F (−15°C), the energy consumption is determined as the kWh per 24 hours corresponding to 5°F (−15°C) average freezer compartment temperature by extrapolating a straight line from the test point and a point on the energy consumption-temperature plot corresponding to 0 kWh per 24 hours at 90°F (32°C) average freezer and fresh food compartment temperatures.

9.5.2.5 For multiple control combination refrigerator-freezers, determine energy consumption as the average kWh per 24 hours of the two values corresponding with the intersection of the temperature curves at 5°F (−15°C) average freezer compartment temperature (see Figure 9-4).

9.5.2.5.1 When one intersection of the 5°F (−15°C) freezer temperature line on the temperature envelope occurs at less than 45°F (7°C) fresh food compartment temperature and the other intersection occurs at greater than 45°F (7°C) fresh food compartment temperature, the energy consumption corresponding to the intersection at 5°F (−15°C) freezer temperature and less than 45°F (7°C) fresh food temperature is determined and the energy consumption corresponding to the intersection of the intersection of the 45°F (7°C) fresh food compartment temperature line with the 5°F (−15°C) freezer temperature line is geometrically determined. The average energy consumption corresponding to these two points of intersection is determined as the unit energy consumption (see Figure 9-4A).

9.5.2.5.2 When the average freezer compartment temperature is always less than 5°F (−15°C), energy consumption is determined as the kWh consumed per 24 hours corresponding to the highest freezer compartment temperature attainable (see Figure 9-4B) provided the food temperature corresponding to the highest freezer temperature is equal to or less than 45°F (7°C). If the average fresh food temperature corresponding to the highest freezer compartment temperature attainable exceeds 45°F (7°C), the energy consumption at 45°F (7°C) fresh food compartment temperature is obtained and the greater of the two values determined as the unit energy consumption (see Figure 9-4C).

9.5.2.5.3 When the average freezer compartment temperature is always greater than 5°F (−15°C), energy consumption is determined as the kWh consumed per 24 hours corresponding to 5°F (−15°C) average freezer compartment temperature by extrapolating the temperature and energy curves to 5°F (−15°C) average freezer compartment temperature, provided the corresponding fresh food compartment temperature is 45°F (7°C) or below (see Figure 9-4D). If the extrapolated curves indicate a fresh food compartment temperature greater than 45°F (7°C) at the 5°F (−15°C) average freezer compartment temperature, the curves are further extrapolated and the energy consumption determined as the kWh per 24 hours corresponding to the 45°F (7°C) fresh food compartment temperature. In all cases, the energy consumption is the lower value corresponding to the intersections resulting from extrapolation of the temperature envelope lines and meeting previous requirements (see Figure 9-4E).

9.5.2.6 For household freezers, determine energy consumption as kilowatt hours (kWh) consumed per 24 hours at 0°F (−18°C) average freezer temperature (see Figure 9-5).

9.5.2.6.1 When the average freezer compartment temperature is always less than 0°F (−18°C), determine energy consumption as the kWh per 24 hours at the warmest obtainable freezer compartment temperature (see Figure 9-5A).

9.5.2.6.2 When the average freezer compartment temperature is always greater than 0°F (− 18°C), determine energy consumption as the kWh per 24 hours that would occur at 0°F (−18°C) by extrapolating the temperature and energy consumption curves to 0°F (−18°C) average freezer compartment temperature (see Figure 9-5B).

9.5.2.6.3 Household Freezers with a fixed temperature control are tested at the fixed control position and with the control short-circuited so that two test points are obtained. Energy consumption is determined as the kWh per 24 hours at the point where the straight line between the two test points crosses the 0°F (−18°C) average freezer compartment temperature line.

If the average freezer compartment temperature between the two test points is always greater than 0°F (−18°C), the linear curve is extrapolated to 0°F (−18°C) and the energy consumption is determined as the kWh per 24 hours corresponding to 0°F (−18°C).

If the average freezer compartment temperature is always less than 0°F (−18°C), the energy consumption is determined as the kWh per 24 hours corresponding to the highest attainable freezer temperature.

If a fixed control household freezer operates 100% of the time at its control position and the average freezer compartment temperature is always greater than 0°F (−18°C), the energy consumption is determined as the kWh per 24 hours corresponding to 0°F (−18°C) average freezer compartment temperature by extrapolating a linear curve from the test point to a point on the energy-temperature chart corresponding to 0 kWh/24 hours at 90°F (32°C) average freezer compartment temperature.

9.6 Data To Be Reported.

9.6.1 Household Refrigerators.

(a) Type, model number, serial number, if any, and manufacturer or brand name of cabinet.

(b) Ambient temperature, typically 90°F (32°C).*

(c) Voltage and frequency, typically 115 volts, 60 Hz.*

(d) Fresh food compartment temperature, typically 38°F (3°C).*

(e) Freezer compartment temperature(s) for

(i) Single control household refrigerators, the freezer compartment temperature corresponding to 38°F (3°C) average fresh food compartment temperature,

(ii) Multiple control combination refrigerator-freezers, the minimum average freezer compartment temperature and the maximum average freezer compartment temperature corresponding to 38°F (3°C) average fresh food compartment temperature.

For a product provided with an anti-sweat heater switch, the freezer compartment temperature is reported with the switch both in the lowest and highest energy consuming positions.

(f) Energy consumed per month (kWh/month) based on a 30-day month is calculated by multiplying the energy consumption in kWh/24 hours as determined by the appropriate subsection of 9.5.2 by 30.

For a product provided with an anti-sweat heater switch, the average energy consumption is reported with the switch in both the lowest and highest energy consuming positions.

9.6.2 Household Freezers.

(a) Type, model number, serial number, if any, and manufacturer or brand name of cabinet.

(b) Ambient temperature, typically 90°F (32°C).*

(c) Voltage and frequency, typically 115 volts, 60 Hz.*

(d) Energy consumed per month (kWh/month) based on a 30-day month, and corrected by the following appropriate multiplication factor:**

Chest freezers — 0.7
Upright freezers — 0.85

For a product provided with an anti-sweat heater switch, the average energy consumption is reported with the switch both in the lowest and highest energy consuming position.

10. METHOD FOR COMPUTING THE ENERGY FACTOR OF HOUSEHOLD REFRIGERATORS AND HOUSEHOLD FREEZERS

10.1 Scope of Section 10. This section provides a standard method for calculating the energy factor of various types of household refrigerators and household freezers.

10.2 Purpose. The purpose for calculating the energy factor is to provide a uniform means of comparing the relative energy efficiency between different products by relating all products to a common base.

10.3 Calculation of Energy Factor:

$$EF = \frac{V_{Fresh\ Food} + (V_{Freezer} \times K)}{EC}$$

where:

$V_{Fresh\ Food}$ = Volume of the fresh food compartment of household refrigerators as determined by Section 4.

$V_{Freezer}$ = Volume of the freezer compartment of household refrigerators as determined by Section 4 or household freezers as determined by Section 5.

K = Adjustment factors as determined in 10.4.

EC = Energy consumption expressed as kWh consumed per 24 hours. This value is obtained as follows:

(1) for household refrigerators: divide the value obtained under 9.6.1 (f) by 30;

(2) for household freezers: after correcting by the appropriate multiplication factor, divide the value obtained under 9.6.2 (d) by 30.

**Although most tests will be conducted at the temperatures and voltages listed after "typically," there may be reason for a manufacturer or test laboratory to run tests at some other condition. Under such a case the condition should be reported so that the results obtained at off standard conditions are recognized as something different than the usual.*

***The 0.7 multiplication factor for chest freezers and the 0.85 multiplication factor for upright freezers represent adjustments to the basic test value proposed by the U. S. Department of Energy and the Department of Commerce in order to make the energy consumption value typical of household usage.*

10.4 Adjustment Factor. The adjustment factor is calculated as follows:

$$\text{Adjustment Factor} = \frac{\text{Test Room Temp} - \text{Freezer Compartment Temp}}{\text{Test Room Temp} - \text{Fresh Food Compartment Temp}}$$

10.4.1 For Basic Refrigerator Type Household Refrigerators

$$\frac{90-15}{90-38} = 1.44$$

10.4.2 For All-Refrigerator Type Household Refrigerators

$$\frac{90-38}{90-38} = 1.00$$

10.4.3 For Combination Refrigerator-Freezer Type Household Refrigerators

$$\frac{90-5}{90-38} = 1.63$$

10.4.4 For Household Freezers

$$\frac{90-0}{90-38} = 1.73$$

11. SAFETY OF HOUSEHOLD REFRIGERATORS AND HOUSEHOLD FREEZERS

It is recommended that Household Refrigerators and Household Freezers intended for installation in the U.S.A. meet the requirements of the latest edition of Underwriters Laboratories Inc., "Standard for Safety, Household Refrigerators and Freezers," UL 250*, ANSI B97.1.

**Copies are available from Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, Illinois 60062; 1285 Walt Whitman Road, Melville, L.I., New York 11746 and 1655 Scott Boulevard, Santa Clara, California 95050.*

FIGURE 9–1
ALL REFRIGERATORS
Format for plotting points and reading results to be reported.

EXAMPLE:

At 38°F Fresh Food Compartment Temperature:
Kilowatt Hours per 24 Hours = 3.3

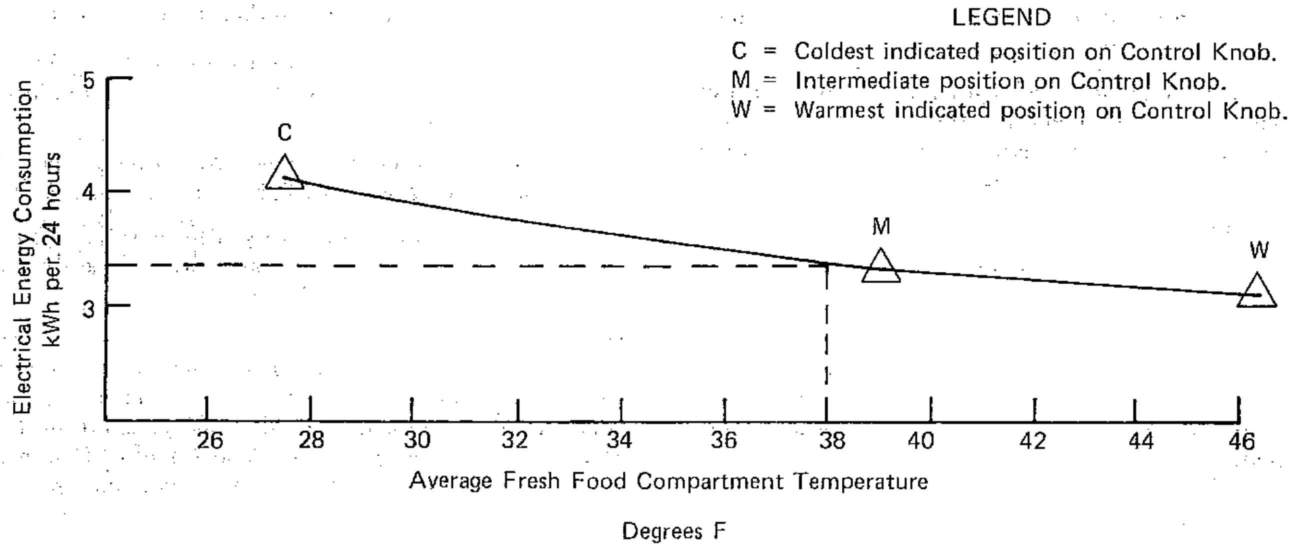


FIGURE 9–1A (SPECIAL CASE)

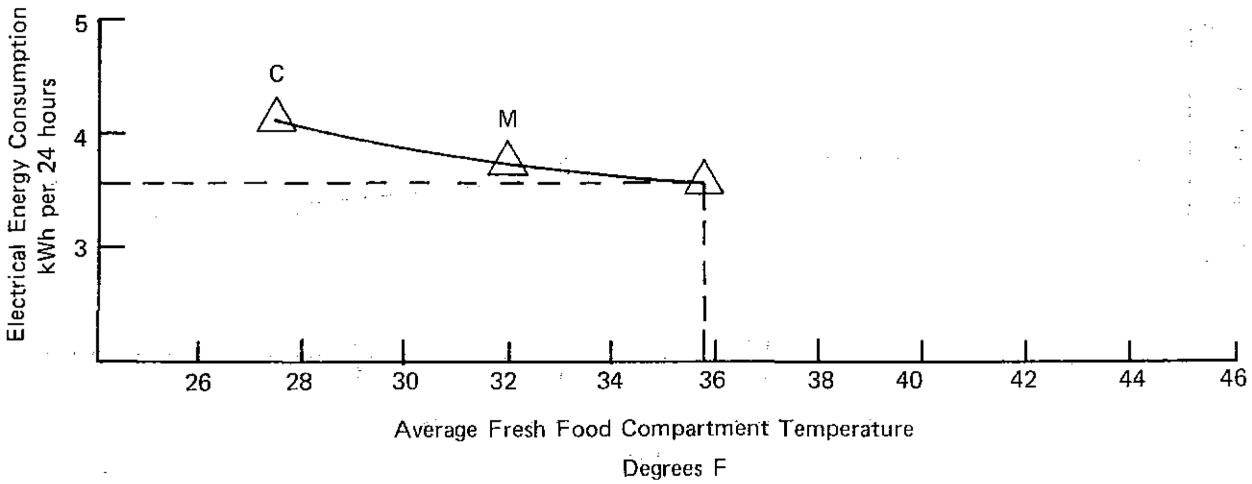
ALL REFRIGERATORS

Format for plotting points and reading results to be reported.

EXAMPLE:

At 35.7°F Fresh Food Compartment Temperature:
Killwatt Hours per 24 Hours = 3.7

NOTE: When average fresh food compartment is always less than 38°F, KWH per 24 hours is to be reported at the highest attainable average fresh food compartment temperature.



LEGEND

C = Coldest indicated position on Control Knob.
M = Intermediate position on Control Knob.
W = Warmest indicated position on Control Knob.

FIGURE 9–1B (SPECIAL CASE)

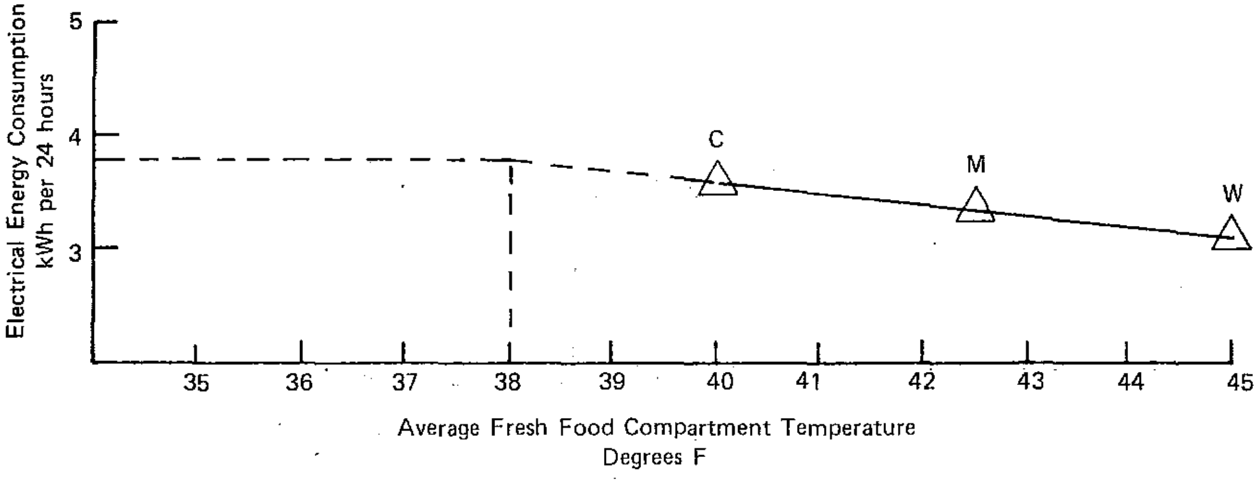
ALL REFRIGERATORS

Format for plotting points and reading results to be reported.

EXAMPLE:

At 38°F Fresh Food Compartment Temperature:
Kilowatt Hours per 24 Hours = 3.8

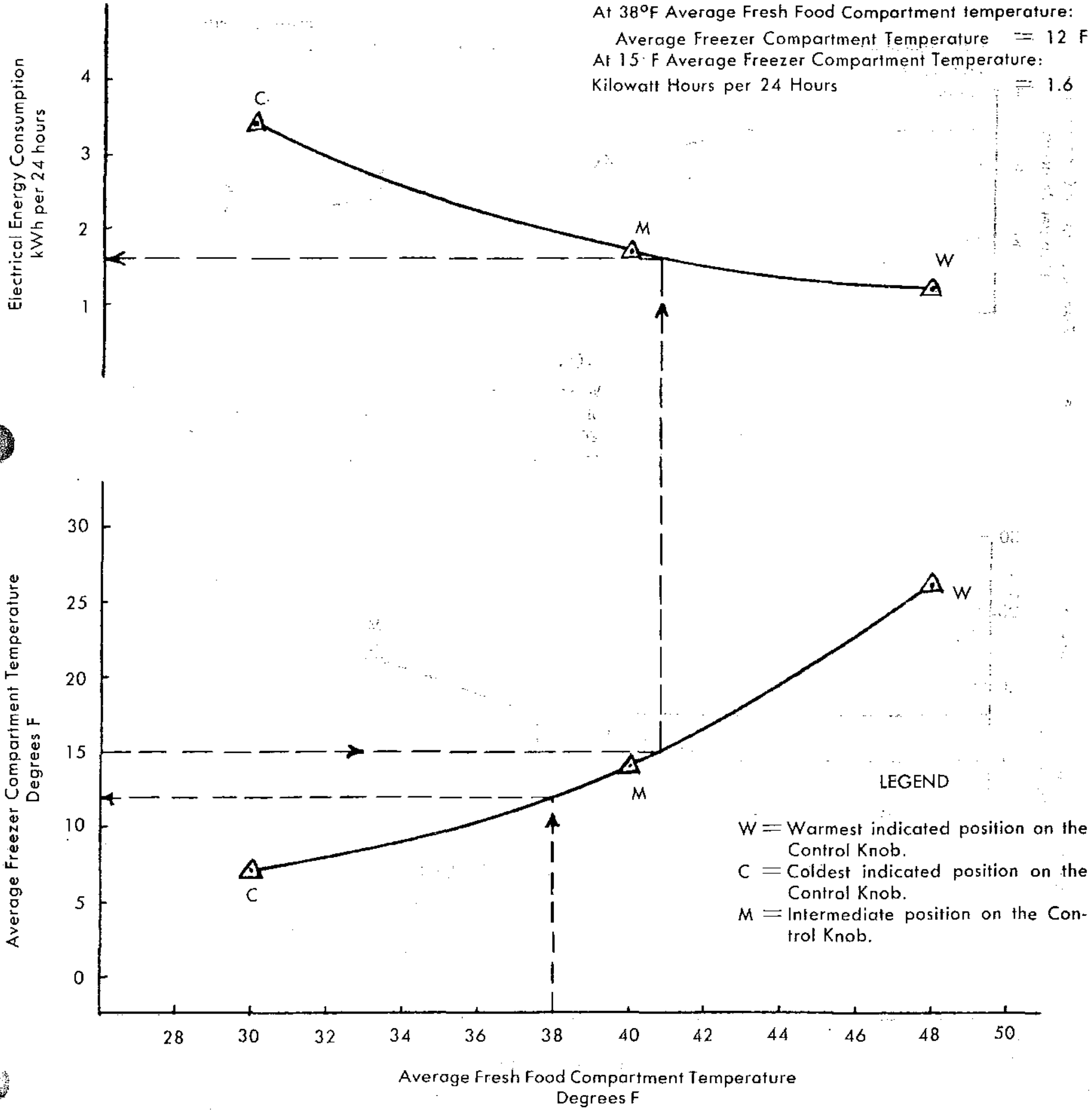
NOTE: When the average fresh food compartment temperature is always greater then 38°F, curve is extrapolated to 38°F and the KWH per 24 hours is reported at this temperature.



LEGEND
C = Coldest indicated position on Control Knob.
M = Intermediate position on Control Knob.
W = Warmest indicated position on Control Knob.

Fig. 9-2

Single Control Basic Refrigerator
Format for plotting points and reading results to be reported



EXAMPLE:

At 38°F Average Fresh Food Compartment temperature:
Average Freezer Compartment Temperature = 12 F
At 15 F Average Freezer Compartment Temperature:
Kilowatt Hours per 24 Hours = 1.6

LEGEND

W = Warmest indicated position on the Control Knob.
C = Coldest indicated position on the Control Knob.
M = Intermediate position on the Control Knob.

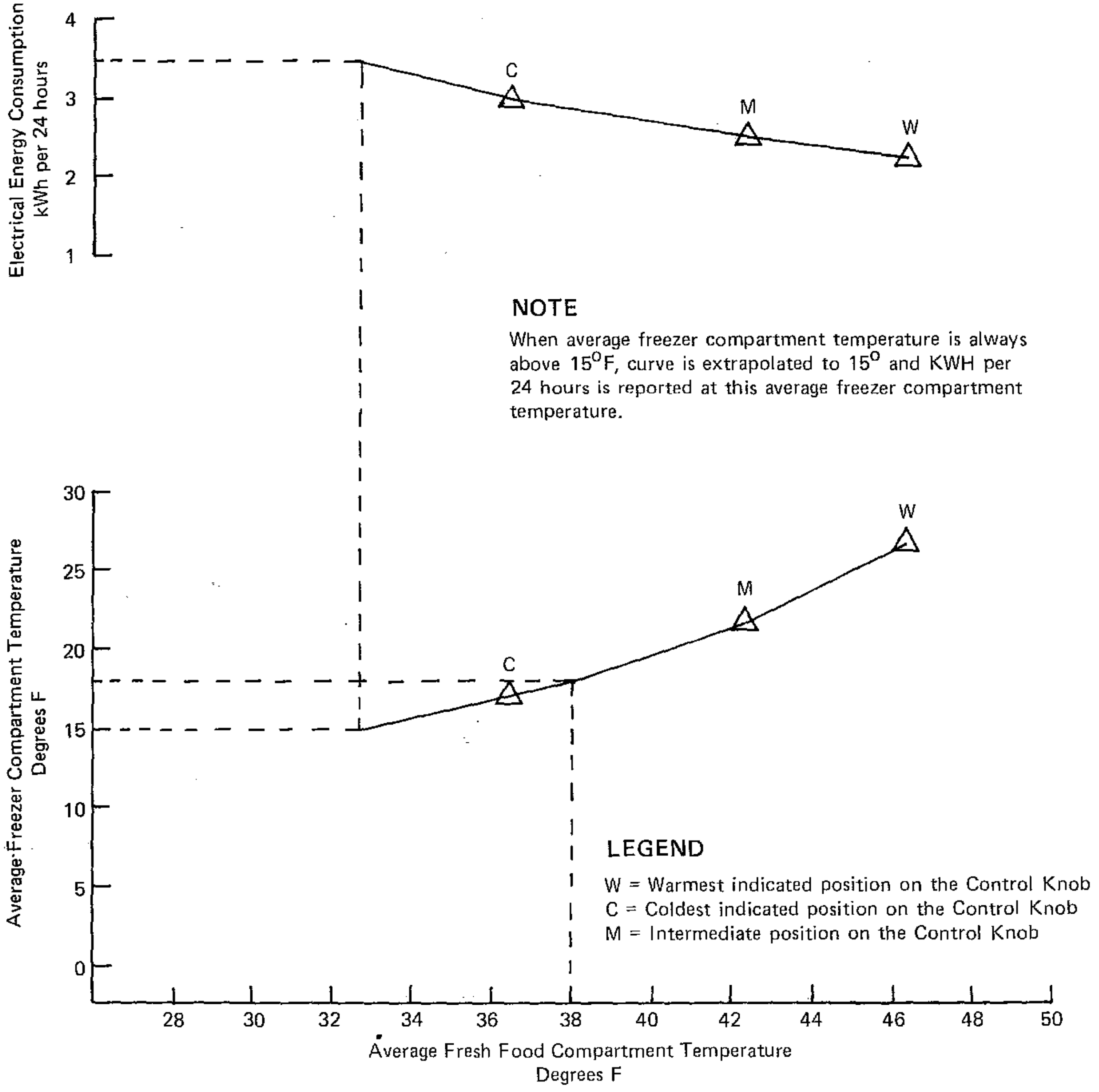
FIGURE 9-2A (SPECIAL CASE)

Single Control Basic Refrigerator
Format for plotting points and reading results to be reported

EXAMPLE

At 38°F Average Fresh Food Compartment Temperature
Average Freezer Compartment Temperature =17^{o}F

At 15^{o}F Average Freezer Compartment Temperature
Kilowatt Hours per 24 Hours =3.6



NOTE

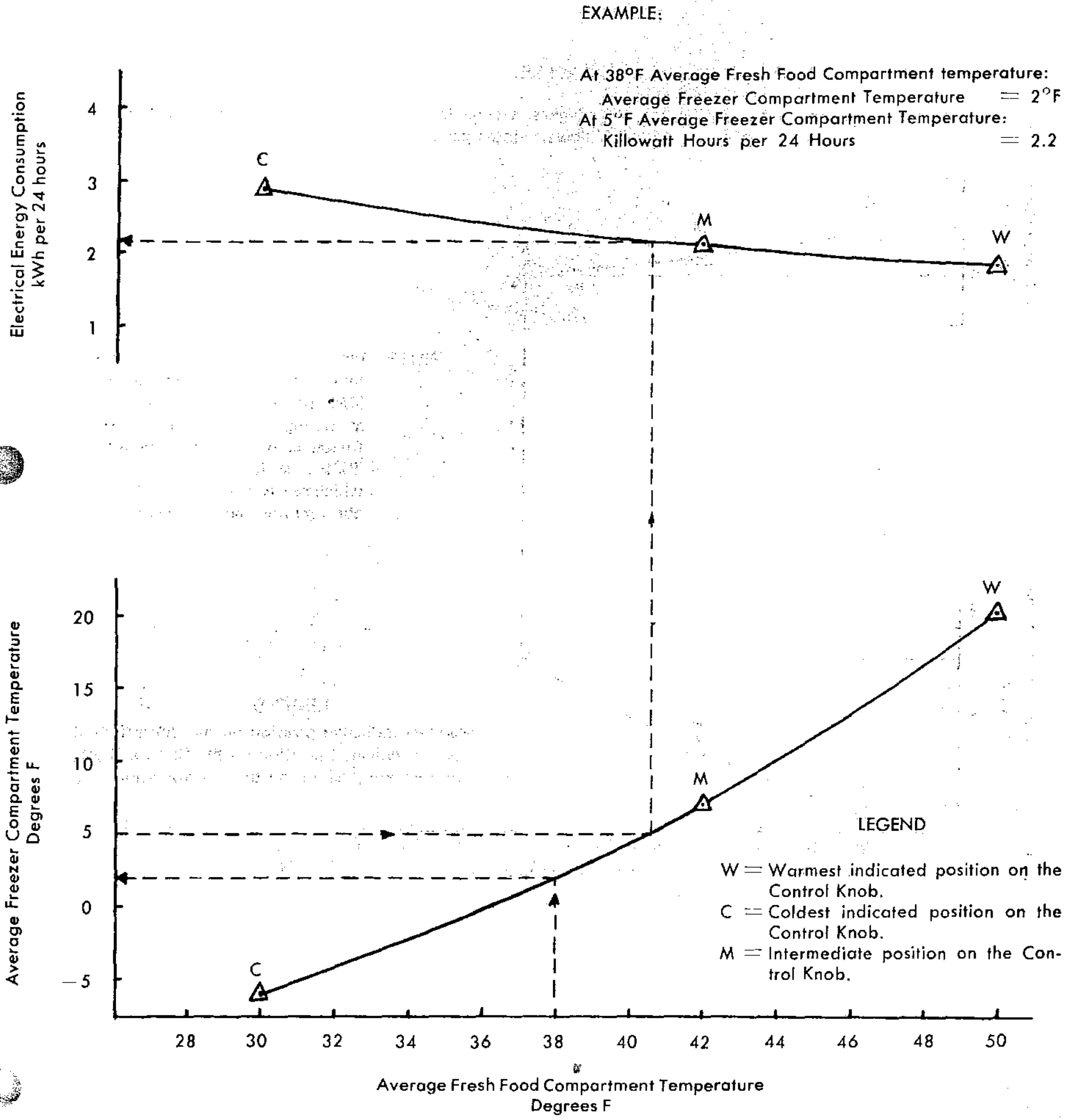
When average freezer compartment temperature is always above 15^{o}F, curve is extrapolated to 15^{o} and KWH per 24 hours is reported at this average freezer compartment temperature.

LEGEND

W = Warmest indicated position on the Control Knob
C = Coldest indicated position on the Control Knob
M = Intermediate position on the Control Knob

Fig. 9-3

Single Control Combination Refrigerator-Freezer
Format for plotting points and reading results to be reported



EXAMPLE:

At 38°F Average Fresh Food Compartment temperature:
Average Freezer Compartment Temperature = 2°F
At 5°F Average Freezer Compartment Temperature:
Killowatt Hours per 24 Hours = 2.2

LEGEND

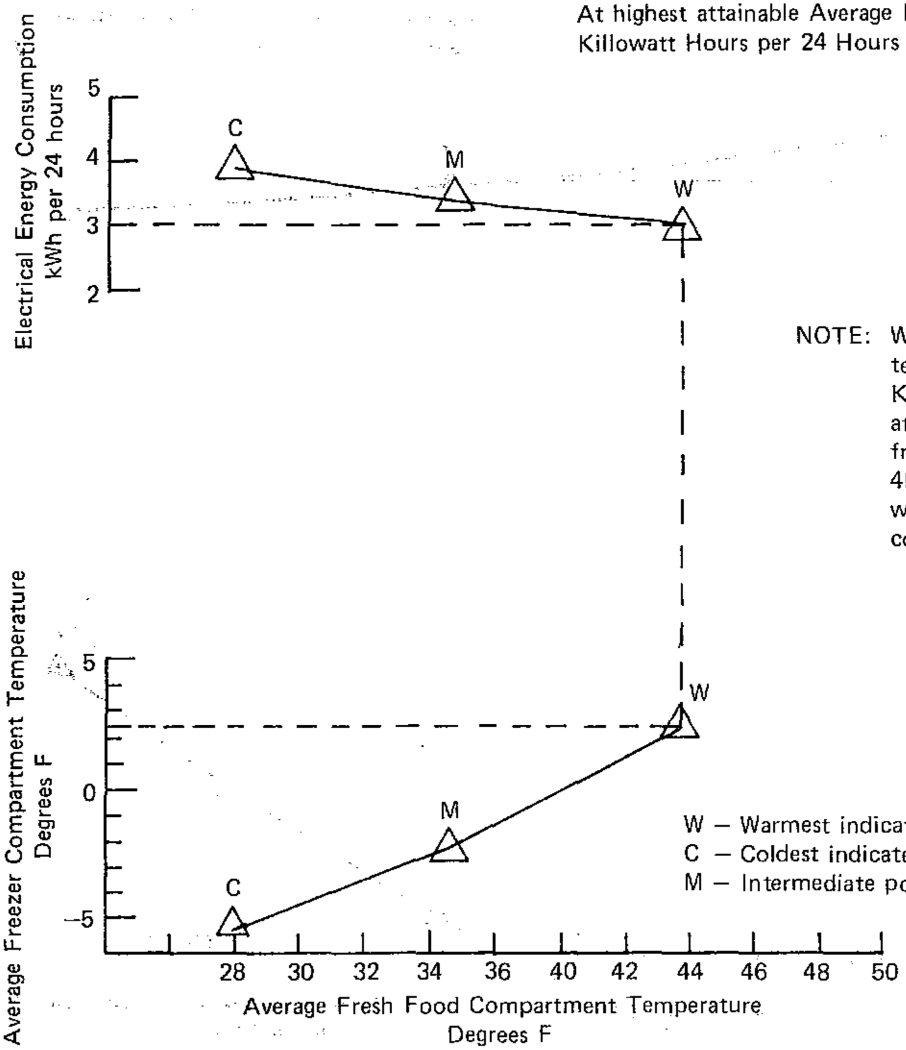
W = Warmest indicated position on the Control Knob.
C = Coldest indicated position on the Control Knob.
M = Intermediate position on the Control Knob.

FIGURE 9–3A (SPECIAL CASE)

Single Control Combination Refrigerator-Freezer
Format for plotting points and reading results to be reported

EXAMPLE:

At highest attainable Average Freezer Compartment Temperature:
Killowatt Hours per 24 Hours = 2.9



NOTE: When average freezer compartment temperature is always less then 5°F, KWH per 24 hours is to be reported at the highest attainable average freezer compartment temperature or 45°F fresh food compartment whichever is the greater KWH consumption (also see Figure 9-3B).

LEGEND

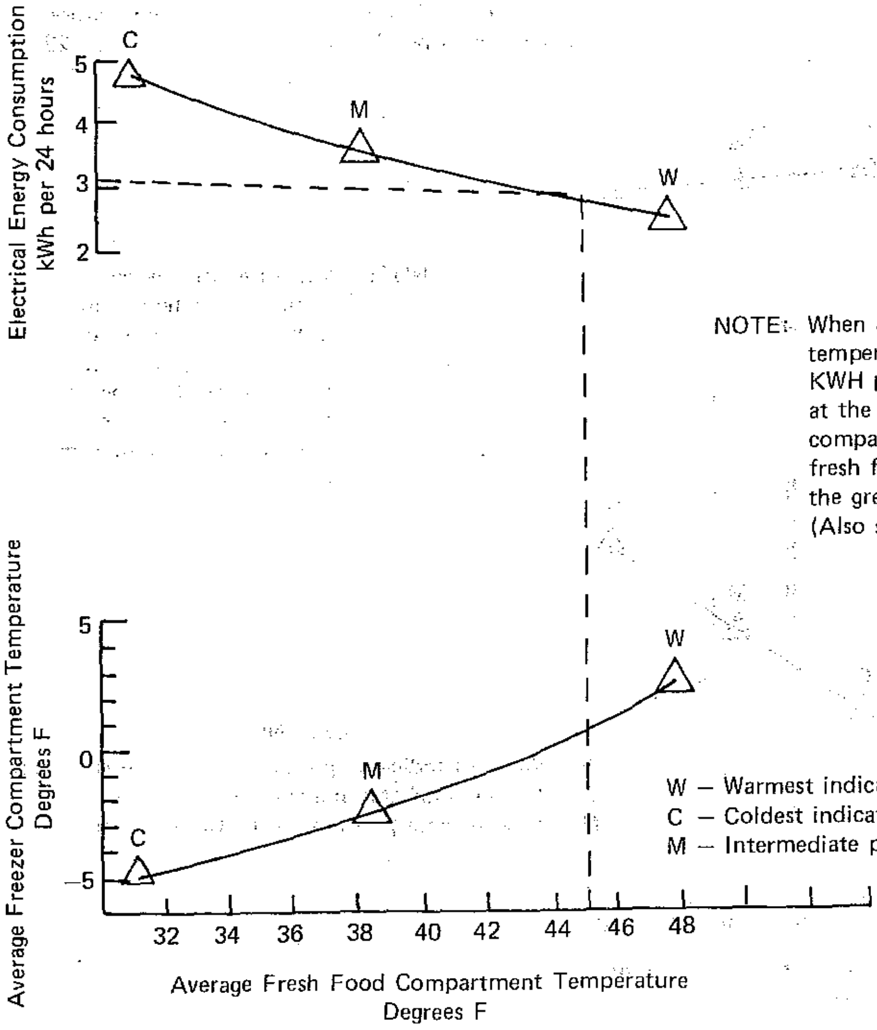
W – Warmest indicated position on the Control Knob
C – Coldest indicated position on the Control Knob.
M – Intermediate position on the Control Knob.

FIGURE 9–3B (SPECIAL CASE)

Single Control Combination Refrigerator-Freezer
Format for plotting points and reading results to be reported

EXAMPLE:

At 45° Average Fresh Food Compartment Temperature:
Killowatt Hours per 24 Hours = 3.1



NOTE: When average freezer compartment temperature is always less than 5°F, KWH per 24 hours is to be reported at the highest attainable average freezer compartment temperature or at 45°F fresh food compartment whichever is the greater KWH consumption. (Also see Figure 9-3A).

LEGEND

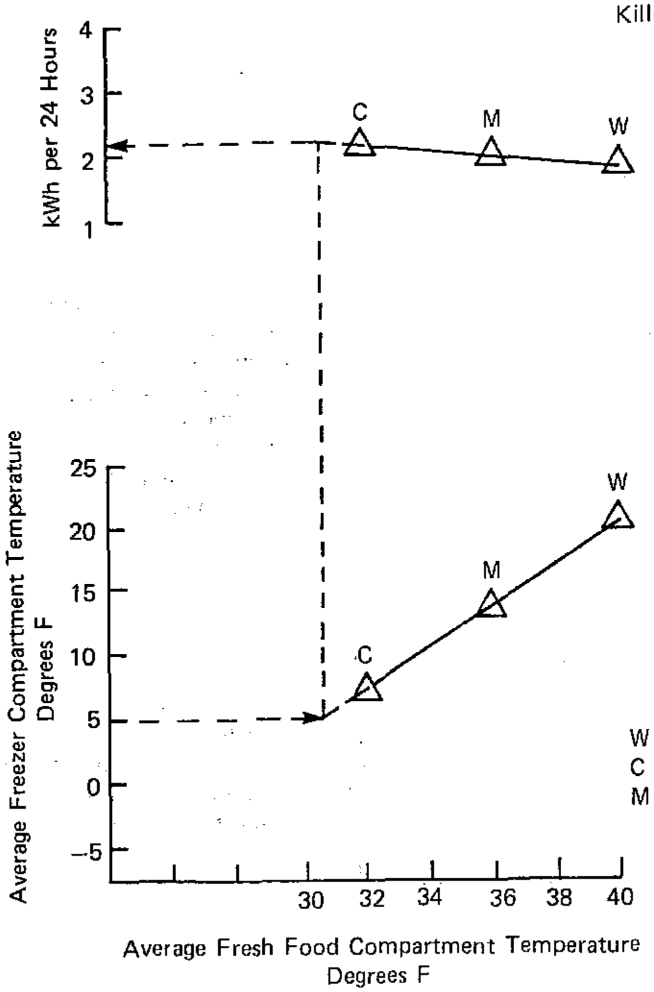
W – Warmest indicated position on the Control Knob.
C – Coldest indicated position on the Control Knob.
M – Intermediate position on the Control Knob.

FIGURE 9–3C (SPECIAL CASE)

Single Control Combination Refrigerator-Freezer
Format for plotting points and reading results to be reported

EXAMPLE:

At 5°F Average Freezer Compartment Temperature:
Killowatt Hours per 24 Hours –22



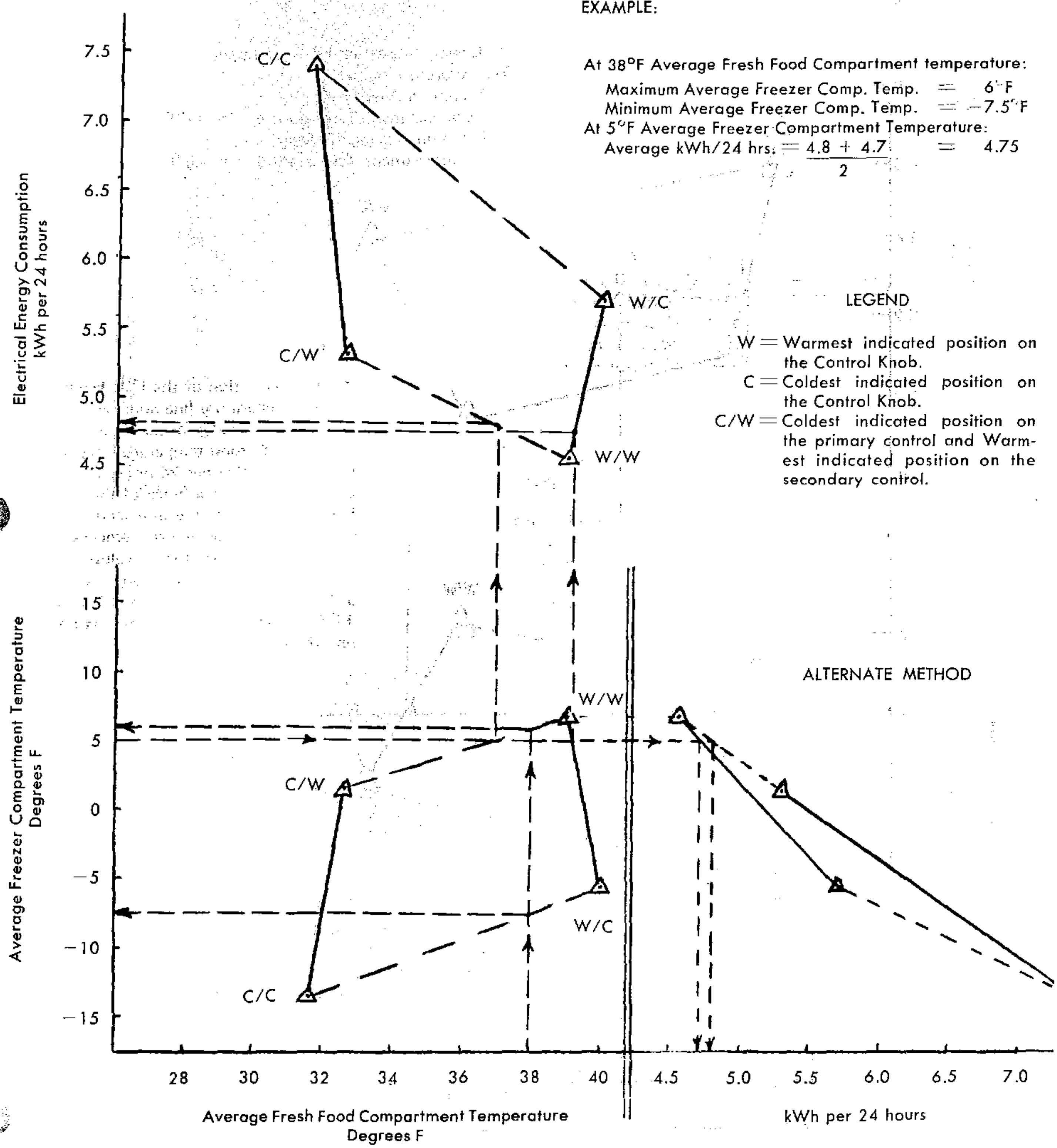
NOTE: When average freezer compartment temperature is always above 5°F, the curve is extrapolated to 5°F and the KWH per 24 hours is reported at this average freezer compartment temperature.

LEGEND

W – Warmest indicated position on the Control Knob.
C – Coldest indicated position on the Control Knob.
M – Intermediate position on the Control Knob.

Fig. 9-4

Multiple Control Combination Refrigerator-Freezer
Format for plotting points and reading results to be reported



EXAMPLE:

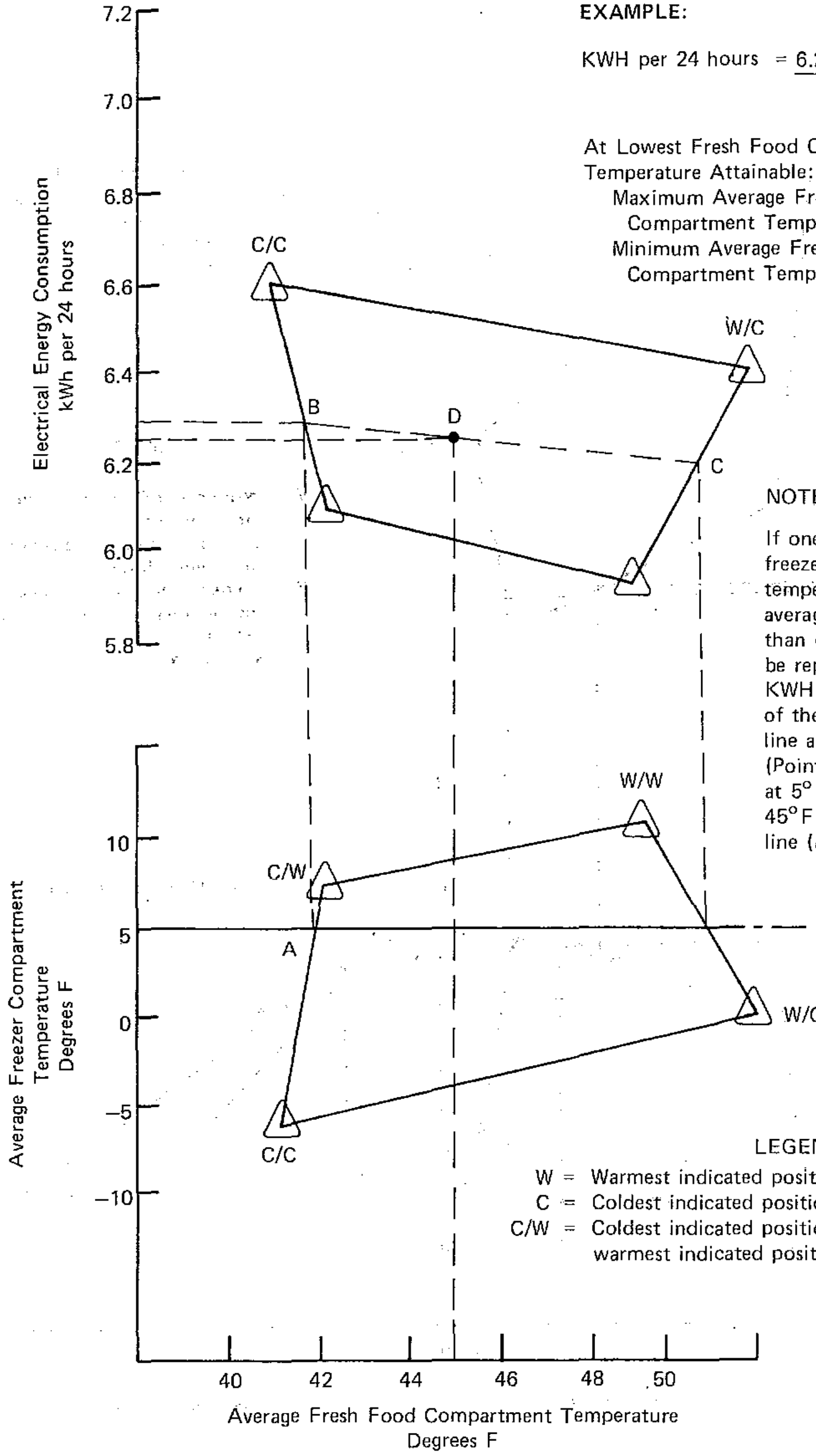
At 38°F Average Fresh Food Compartment temperature:
Maximum Average Freezer Comp. Temp. = 6°F
Minimum Average Freezer Comp. Temp. = −7.5°F
At 5°F Average Freezer Compartment Temperature:
Average kWh/24 hrs. $= \frac{4.8 + 4.7}{2} = 4.75$

LEGEND

W = Warmest indicated position on the Control Knob.
C = Coldest indicated position on the Control Knob.
C/W = Coldest indicated position on the primary control and Warmest indicated position on the secondary control.

FIGURE 9–4A (SPECIAL CASE)

Multiple Control Household Combination Refrigerator Freezer
Format for plotting points and reading results to be reported.



EXAMPLE:

$$\text{KWH per 24 hours} = \frac{6.25 + 6.30}{2} = 6.275$$

At Lowest Fresh Food Compartment Temperature Attainable:
Maximum Average Freezer Compartment Temperature = +7°F
Minimum Average Freezer Compartment Temperature = –6°F

NOTE:

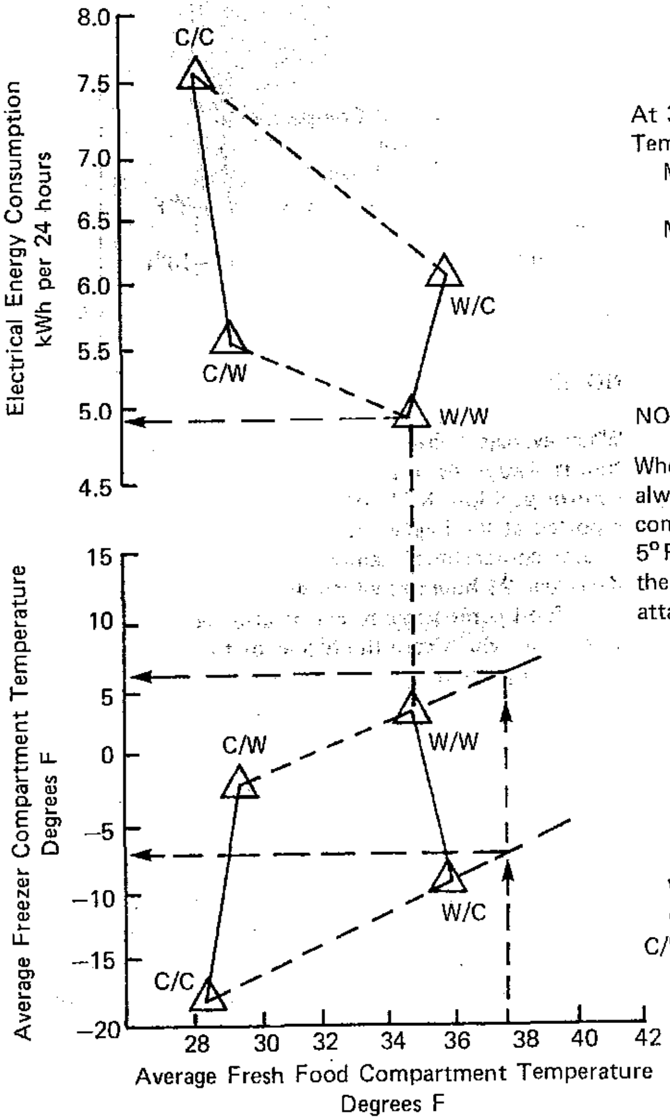
If one intersection of the 5°F average freezer temperature line and the temperature envelop occurs at an average fresh food temperature higher than 45°F, KWH per 24 hours is to be reported as the average of the KWH consumed at the intersection of the 5°F average freezer temperature line and the temperature envelope (Point A) and the power consumption at 5°F average freezer (Line BC) and 45°F average fresh food temperature line (Point D).

LEGEND

W = Warmest indicated position on the Control Knob.
C = Coldest indicated position on the Control Knob.
C/W = Coldest indicated position on primary control and warmest indicated position on the secondary control.

FIGURE 9–4B (SPECIAL CASE)

Multiple Control Combination Refrigerator Freezer
Format for plotting points and reading results to be reported.



EXAMPLE:

At 3°F average freezer compartment temperature:
KHW/24 hours = 4.8

At 38°F Average Fresh Food Compartment Temperature Attainable:
Maximum Average Freezer Compartment Temperature = 7°F
Minimum Average Freezer Compartment Temperature = – 7°F

NOTE:

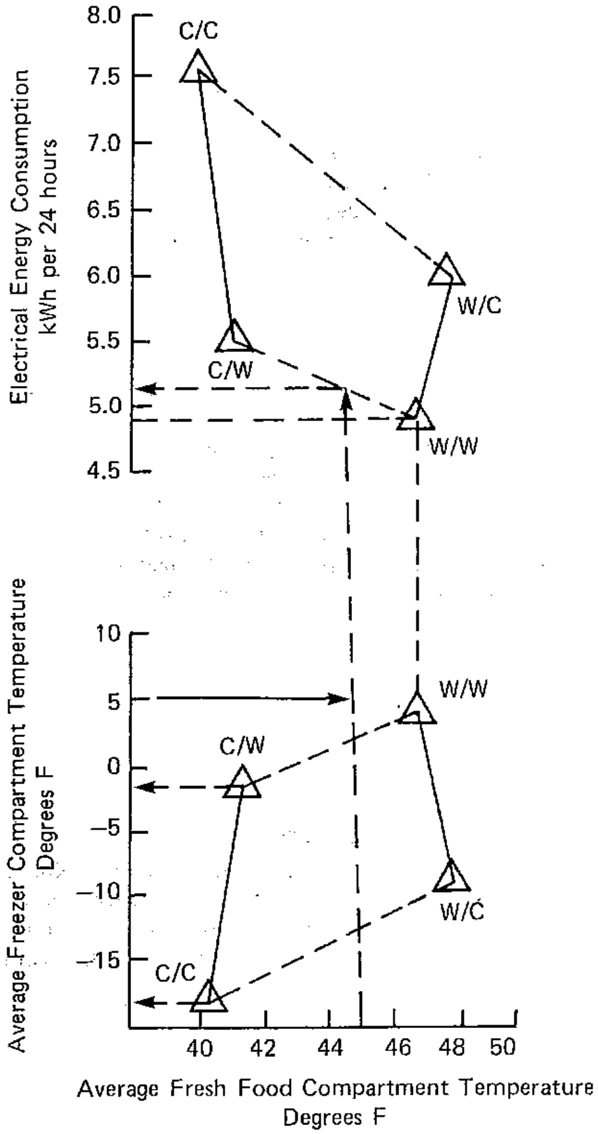
When the average fresh food compartment is always less then 38°F and the freezer compartment temperature is always less than 5°F regardless of the position of the controls, the KWH per 24 hours is reported at the highest attainable freezer compartment temperature.

LEGEND

W = Warmest indicated position on the Control Knob.
C = Coldest indicated position on the Control Knob.
C/W = Coldest indicated position on primary control and warmest indicated position on the secondary control.

FIGURE 9–4C (SPECIAL CASE)

Multiple Control Combination Refrigerator Freezer
Format for plotting points and reading results to be reported.



EXAMPLE:

At 45°F average Fresh Food Compartment temperature:
KWH/24 hours = 5.1
(Higher of the two values shown.)

At Lowest Fresh Food Compartment
Temperature Attainable:
Maximum Average Freezer
Compartment Temperature = –2°F
Minimum Average Freezer
Compartment Temperature = –18°F

NOTE:

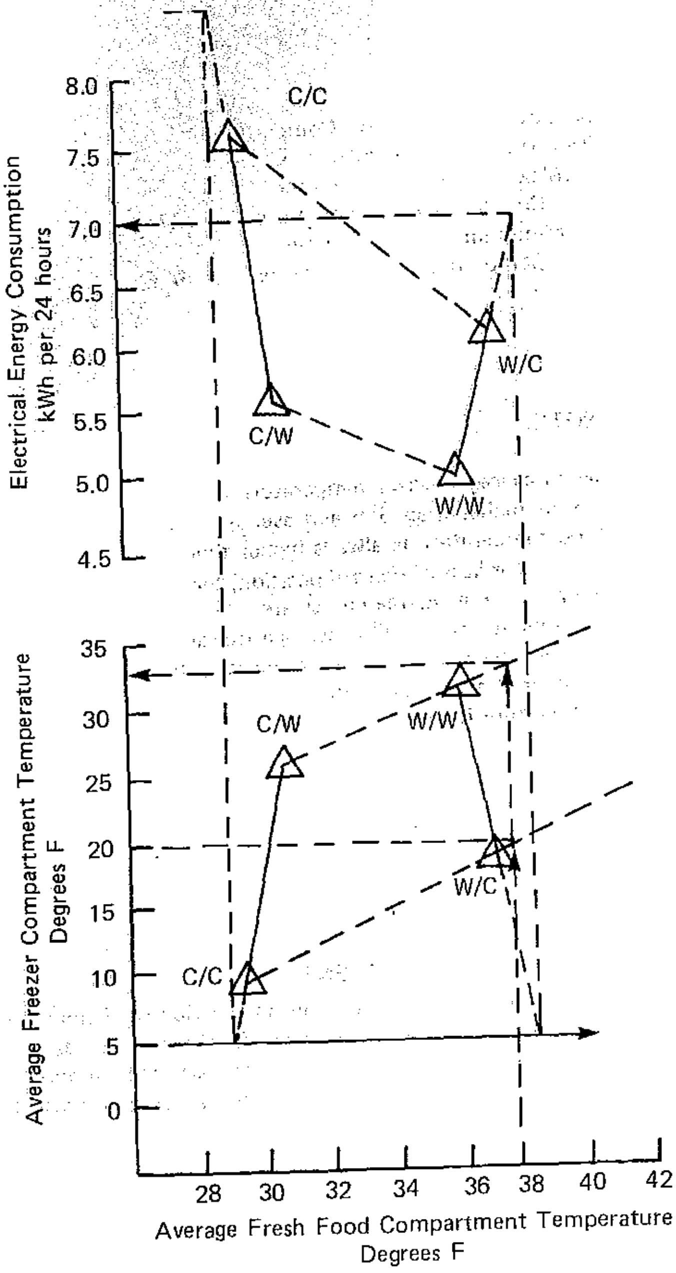
When average freezer compartment temperature is always less than 5°F, regardless of control position, KWH per 24 hours is reported at the highest attainable average freezer compartment temperature unless the KWH per 24 hours at which 45°F average fresh food compartment can be attained is greater, in which case the higher of the two values is reported.

LEGEND

W = Warmer indicated position on the Control knob.
C = Coldest indicated position on the Control knob.
C/W = Coldest indicated position on primary control and warmest indicated position on the secondary control.

FIGURE 9–4D (SPECIAL CASE)

Multiple Control Combination Refrigerator Freezer
Format for plotting points and reading results to be reported.



EXAMPLE:

At 5°F Average Freezer Compartment Temperature
kWh 24 hours = 7.0

(Lower of two values shown)

At 38°F Average Fresh Food Compartment Temperature Attainable:

Maximum Average Freezer Compartment Temperature	= 33°F
Minimum Average Freezer Compartment Temperature	= 20°F

NOTE:

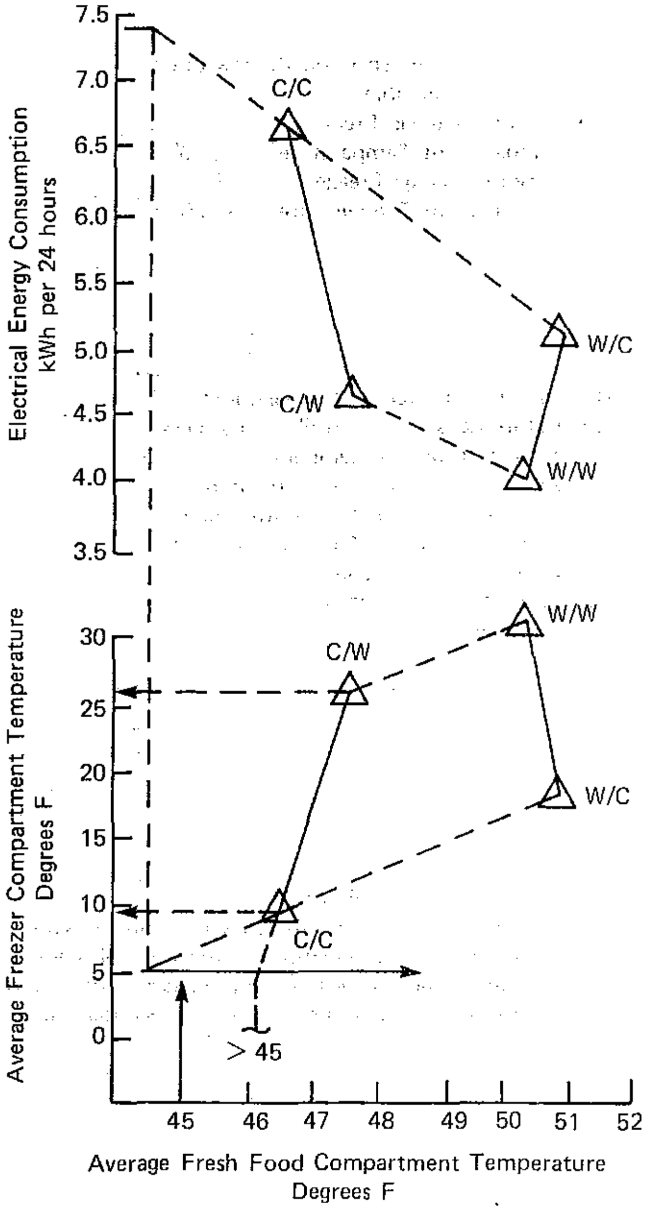
When the average freezer compartment temperature does not reach 5°F regardless of control position, the temperature envelope curves are to be extrapolated to the 5°F average freezer temperature line. The lower value of the KWH per 24 hours is to be reported. Extrapolate the lines that cause the greatest effect on the freezer temperature.

LEGEND

W = Warmest indicated position on the Control Knob.
C = Coldest indicated position on the Control Knob.
C/W = Coldest indicated position on primary control and warmest indicated position on the secondary control.

FIGURE 4E (SPECIAL CASE)

Multiple Control Combination Refrigerator Freezer
Format for plotting points and reading results to be reported.



EXAMPLE:

At 5°F Average Freezer Temperature
KWH/24 hours = 7.4

At Lowest Fresh Food Compartment Temperature Attainable:
Maximum Average Freezer Compartment Temperature = 27°F
Minimum Average Freezer Compartment Temperature = 9°F

NOTE:

When average freezer temperature is always higher than 5°F and average fresh food temperature is always higher than 45°F regardless of control position, the temperature envelope curves are extrapolated to the 5°F average freezer temperature line. No intersection is to be considered at average fresh food temperature higher than 45°F.

LEGEND

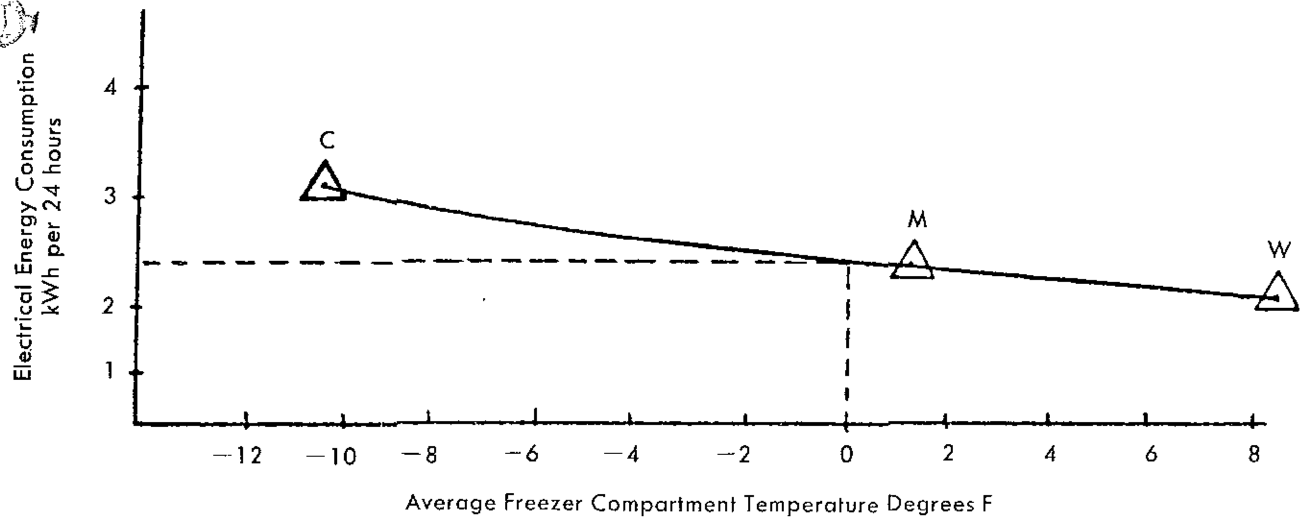
W = Warmest indicated position on the Control Knob.
C = Coldest indicated position on the Control Knob.
C/W = Coldest indicated position on primary control and warmest indicated position on the secondary control.

Fig. 9-5

Household Freezers
Format for plotting points and reading results to be reported

EXAMPLE:

At 0°F Average Freezer Compartment Temperature:
Kilowatt Hours per 24 Hours = 2.2



LEGEND

C = Coldest indicated position on Control Knob.
M = Intermediate position on Control Knob.
W = Warmest indicated position on Control Knob.

FIGURE 9–5A (SPECIAL CASE)

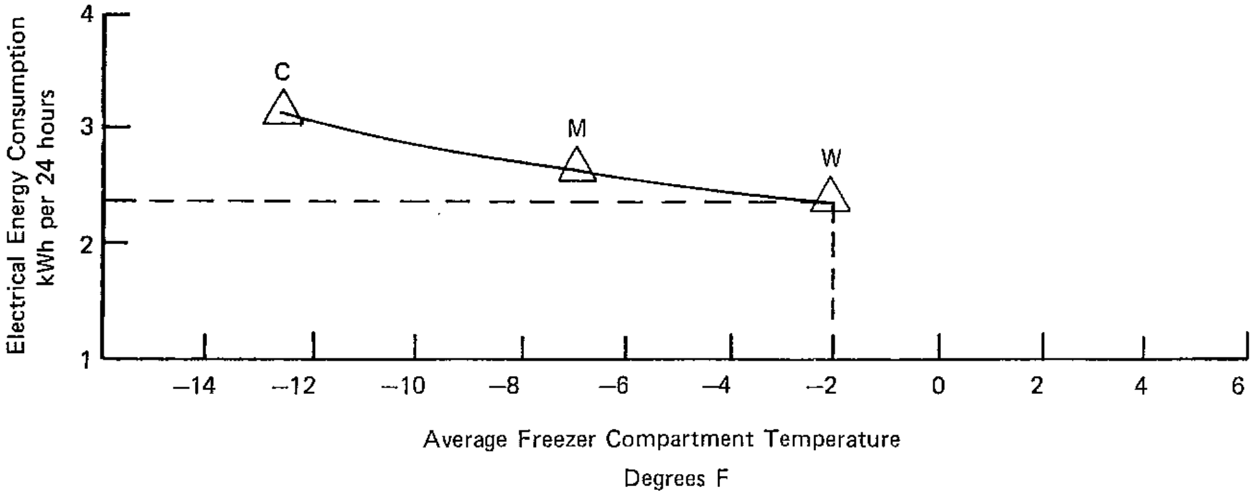
Household Freezers

Format for plotting points and reading results to be reported.

EXAMPLE:

At –2°F (warmest) Average Freezer Compartment Temperature:
Kilowatt Hours per 24 Hours = 2.3

NOTE: When average freezer compartment temperature is always less than 0°F, the KWH per 24 hours is reported at the warmest average freezer compartment temperature obtainable.



LEGEND

C = Coldest indicate position on Control Knob.
M = Intermediate position on Control Knob.
W = Warmest indicated position on Control Knob.

FIGURE 9–5B (SPECIAL CASE)

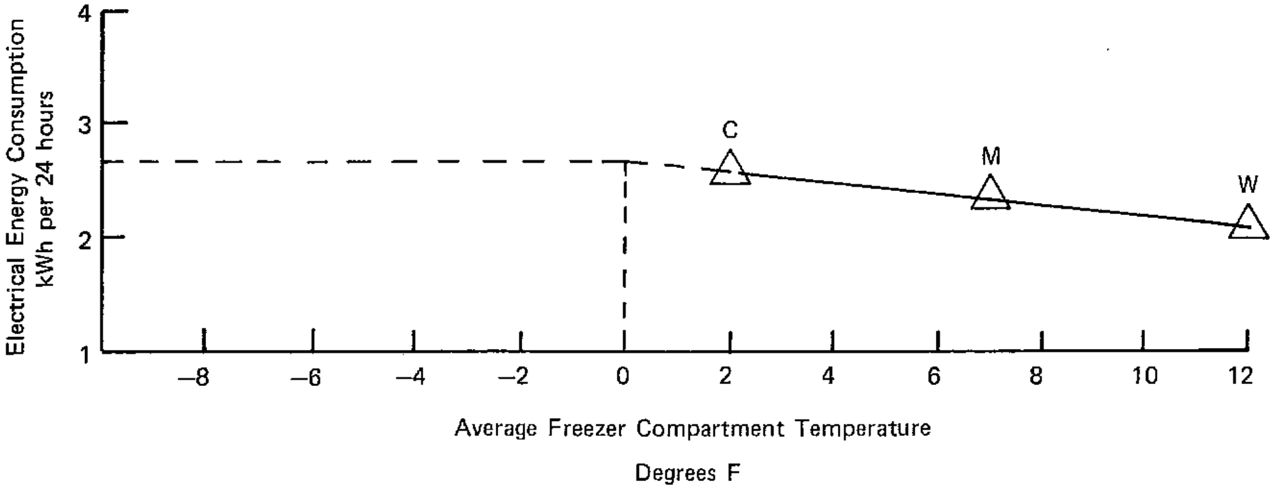
Household Freezers

Format for plotting points and reading results to be reported.

EXAMPLE:

At 0°F Average freezer Compartment Temperature:
Kilowatt Hours per 24 Hours = 2.7

NOTE: When average freezer compartment temperature is always above 0°F, the curve is extrapolated to 0°F and the KWH/per 24 hours is reported at this average freezer compartment temperature.



LEGEND
C = Coldest indicated position on Control Knob.
M = Intermediate position on Control Knob.
W = Warmest indicated position on Control Knob.